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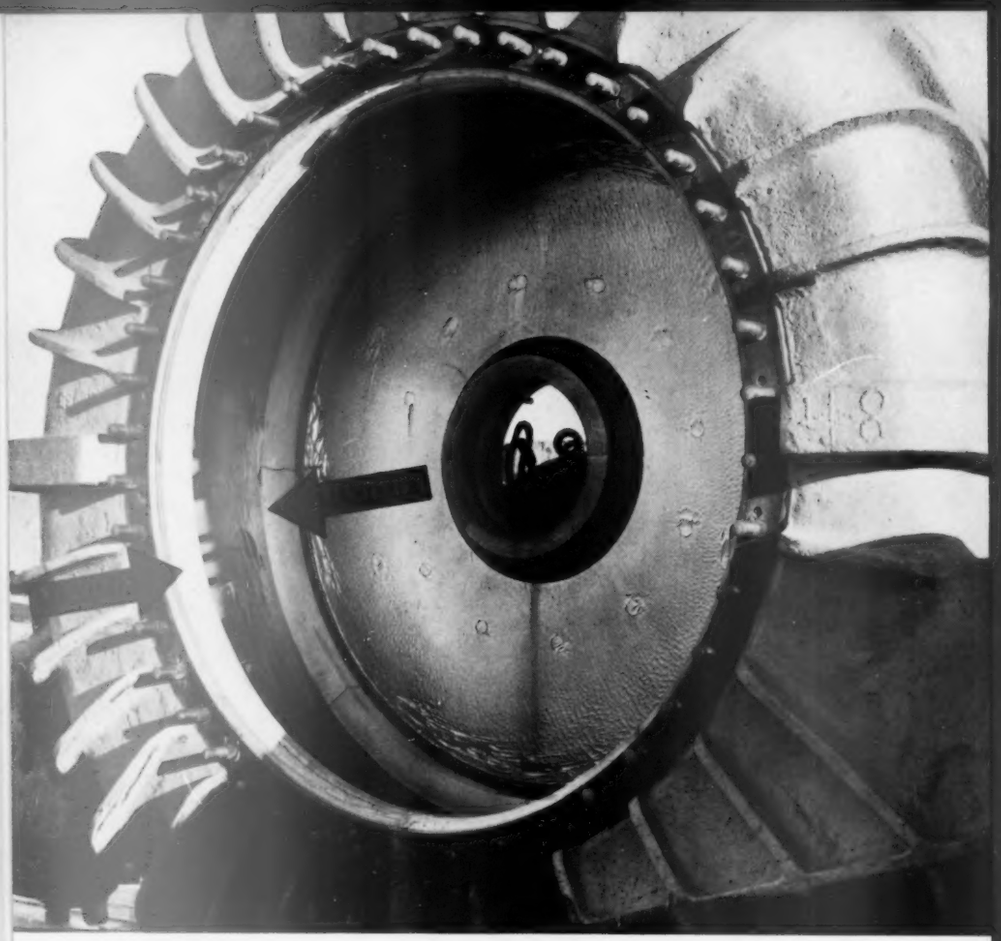


Comparison of MAXIMIX RUBBER with METAL after Pumping 1,200,000 yd

Two pumps in the same line, one pump w Maximix Rubber Parts and the other w similar parts of the hardest, practical all steel. Both pumps handled 1,200,0 yards of the same material. Maxim Rubber (indicated by colored arrows) sho practically no wear, while the equivale metal parts (indicated by white arro are worn to the extent that they requ replacement with new "more-expensiv than-rubber" parts . . . The side plate lin and other parts of the Hydroseal Dred Pump are moulded of Maximix Rubb which generally outlasts metal three to times. The Hydroseal Principle of introd ing clear water on each side of the imp ler invariably saves 35% in pumping pow costs. Address the nearest office listed b low for a copy of new Catalog No. 3-83

HYDRO SEA

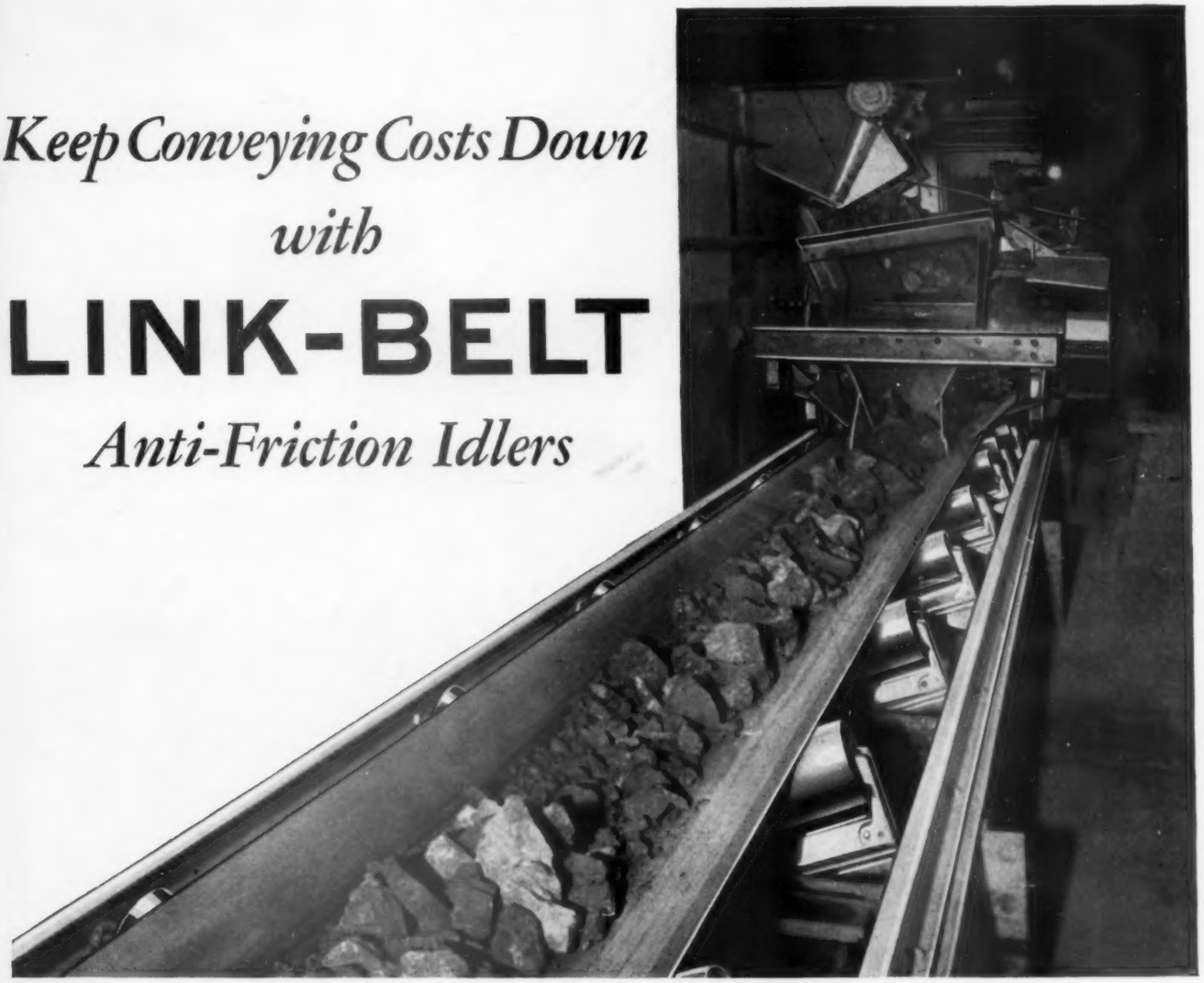
Dredge Pump *MAXIMIX* Protect

PRINT IN BI

Keep Conveying Costs Down with

LINK-BELT

Anti-Friction Idlers



Link-Belt 30-in. wide anti-friction belt conveyor fed by traveling manganese steel apron feeder handling run-of-mine copper ore.

POSITIVE SELF-ALIGNING IDLER

This Link-Belt positive self-aligning idler automatically and positively maintains troughed conveyor belts central at all times. It has met with unqualified success, and is preferred by many who have heretofore used the counterweighted disc type of self-aligning idler.

● Free turning, accurately made idlers assure the belt conveyor a good roadbed for economical operation . . . minimum friction loads . . . long belt life . . . and the lowest maintenance cost. Link-Belt makes a full line of anti-friction pressure lubricated idlers, as well as all necessary machinery and driving parts for the complete conveyor.

Submit your conveying and power transmission problems to Link-Belt. Send for catalog. Address Link-Belt Company, Chicago, Philadelphia, Indianapolis, Atlanta, San Francisco, Toronto, or any of our offices located in principal cities.

5949

PIT AND QUARRY, March, 1937, Vol. 29, No. 8. Published monthly by the Complete Service Publishing Company, 538 South Clark Street, Chicago, Ill. Subscription price: $2 for 3 years, $1 for 1 year in the U. S. and possessions. Canada and Central and South America: elsewhere $1 additional for each year. Single copies 20 cents. Entered as second-class matter November 28, 1932, at the Post-Office at Chicago, Ill., under the Act of March 3, 1879.

Tough Rope for Tough Jobs

"Flex-Set" Preformed Yellow Strand is especially recommended for hoist line, crowd rope, rack rope and swinging lines on power shovels; for dragline and hoist line on dragline machines; for holding line and closing line on clam shell buckets.

Almost any wire rope will serve well enough in some places—but where the going is rough—*and tough,* there "Flex-Set" Preformed Yellow Strand shows its super-quality—its unquestioned ability to *"take it,"* and *"like it."*

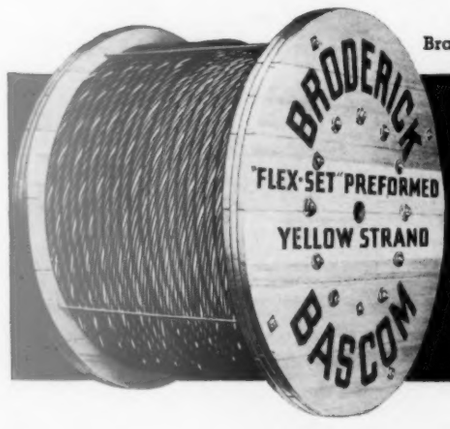
This is the same Yellow Strand that has been "taking it" successfully for many years—the same specially drawn wire, tested and selected—the same careful manufacture by the same company that is now *61 years young.*

The difference results from preforming, which sets the strands to the helical form they maintain permanently in the finished rope. Thus "Flex-Set" Preformed Yellow Strand is largely pre-broken in. It is limp—easy to handle and install—highly resistant to kinking, fatigue and wear.

With these properties, how could it be other than economical? Try it!

BRODERICK & BASCOM ROPE CO., St. Louis

Branches: New York, Chicago, Seattle, Portland, Houston; Factories: St. Louis, Seattle, Peoria U-9



"Flex-Set" Preformed YELLOW STRAND

GH YARDAGE WALKING DRAGLINE *plus*
he Economy of a Diesel
Designed for Dragline Work

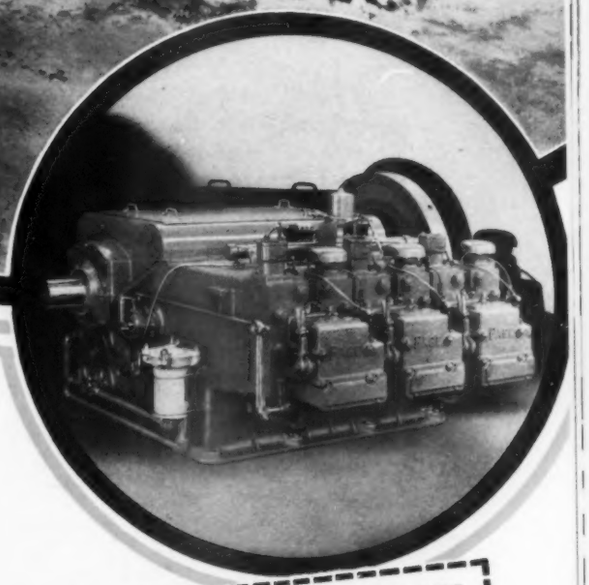
PAGE WALKER SERIES "600"

3 to 5 Yard Machines — Moderately Priced

With hoist, load, and swing speeds for high yardage 24 hours per day, and a simple positive walking mechanism for immediate movability in any direction on even the softest ground, Page Walkers also bring to dragline users a medium speed, horizontal, heavy duty engine designed particularly for the severe demands of dragline service.

Because Page Diesels have been built especially for dragline use, many fourteen and fifteen years old are still in constant operation.

If you require more and cheaper yardage, continuous operation every day, month after month, and complete independence of weather conditions, investigate thoroughly the Page Walkers powered by the Page Diesel!



For information write—

Page Engineering Co.

Clearing Post Office " " Chicago, Ill.

PAGE AUTOMATIC DRAGLINE BUCKETS
PAGE WALKING DRAGLINE MACHINES
PAGE DIESEL ENGINES

PAGE ENGINEERING COMPANY
CLEARING POST OFFICE CHICAGO, ILLINOIS

Please send information on a Page "600" Walker. Size _____

Name _____

Address _____

City _____ *State* _____ "F"

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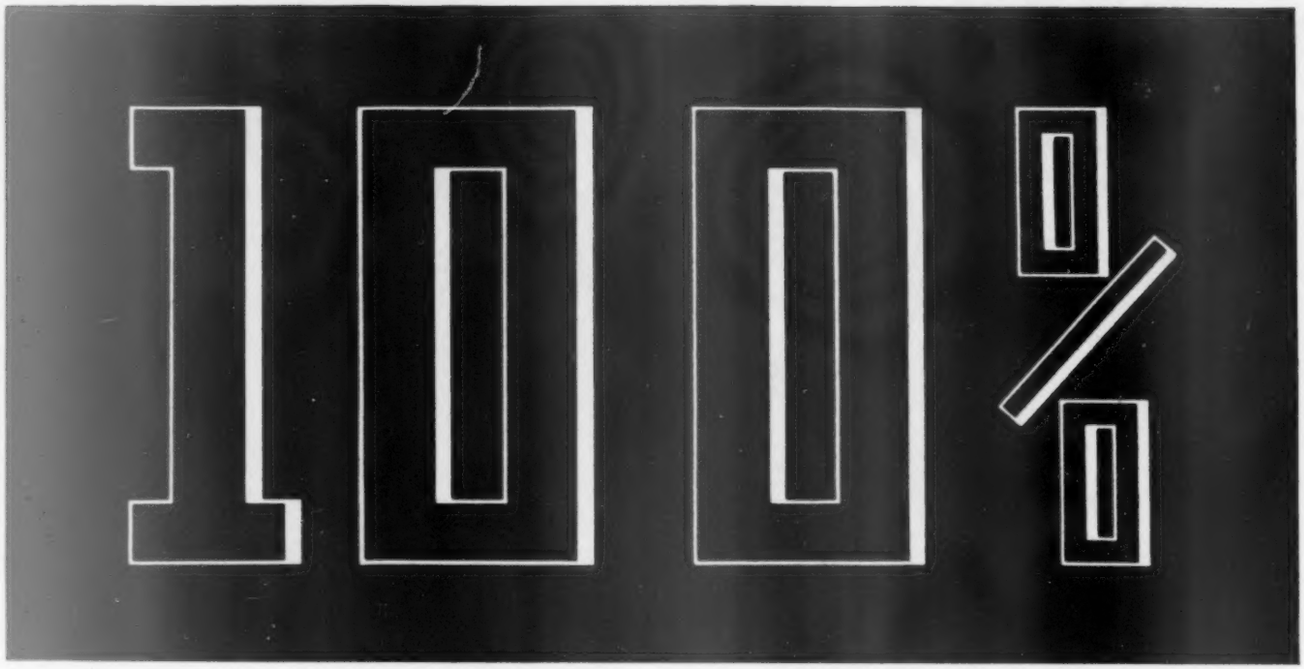


CINCINNATI EQUIPPED 100%

that's a "knock-out" blow to Conveyor Belt Costs

And that's what many alert operators in the sand and gravel, crushed rock, stone, brick, and other industries are doing . . . they're going Cincinnati 100%. And they're giving conveyor belt costs per ton conveyed a "knock-out" blow. This trend started when plants in these industries began to multiply results from a Cincinnati Belt comparison by the number of belts required in their plants . . . it gave them the answer for greater efficiency and economy.

Big tonnage . . . low belt cost per ton conveyed . . . years of service . . . have long been outstanding advantages of Cincinnati Conveyor Belts. One Cincinnati Belt in your plant will give you first hand knowledge of why Cincinnati Belts win their way to 100% endorsement. Investigate now for your next replacement.

THE CINCINNATI RUBBER MFG, CO. - - - CINCINNATI, OHIO

New York Detroit Chicago Boston Pittsburgh Buffalo Atlanta

CINCINNATI *Conveyor* BELTS

They Checked Up ··· AND BOUGHT JAEGERS

"After checking merits decided to buy two Jaeger 3-yd. Agitators. When more are purchased our choice will again be Jaegers."
HENRY BICKEL CO., Louisville, Ky.

"Our observation covering competitive mixers in Miami area reveals Jaegers are in a class by themselves. Our first installation of three was followed by 7 additional in three months."
W. M. DABNEY, INC., Miami Beach, Fla.

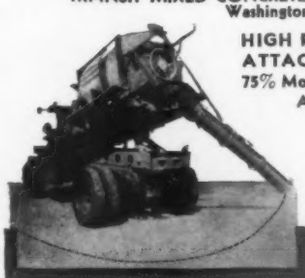
"Have operated other makes but my Jaegers fulfill all demands 100% for accurate performance and low operating cost."
FRED C. KNAUER, Branchville, Md.

"Have had four Jaegers in past 4½ years—have given us exceptionally good service—get a wonderful mix and it takes less time than in other types we have rented. Maintenance costs have been very low. Have been averaging 100 cu. yds. of concrete per day for last 7 months. We recommend your Mixer to prospective buyers."
MARION COAL & SUPPLY CO., Pittsburgh, Pa.

"Since we bought our first Jaeger, nearly three years ago, we have been sold on it, as the machine, operated with competition, has been our best salesman. Economy, service and the way the machine does its job under all conditions led us to reorder two Jaegers."
TRANSIT MIXED CONCRETE CO., INC. Washington, D. C.

"Before going into truck mixers," states KEEFNER CONCRETE & MATERIAL CO., Des Moines, Ia., "we thoroughly analyzed and investigated all competitive equipment. Our decision to purchase Jaegers has proven very wise for several reasons. First, an immediate increase in our business. Second, while parts needed have been negligible, it is a satisfaction to buy them from a dealer still in business. Third, it is a well balanced, most economical outfit to operate. Some of our mixers are on their third chassis. After observing other ready mixed operations in various parts, we feel our Jaegers give a more thorough mix, discharge is fast and continuous—without segregation. Fewer spaders and puddlers required. They are easy on trucks, surprisingly long tire life and mileage. Have our unqualified recommendation."

Plant after plant, both newcomers and veterans, are finding that the way to get the most customers and the most profit for their sand, stone and cement is to sell Jaeger HIGHER STRENGTH Concrete, mixed and delivered in Jaeger Dual-Mix Truck Mixers. When they check up they find that Jaeger End-to-End Mass Mixing and Smooth, Continuous Flow Discharge produce a stronger, more workable concrete preferred by both engineers and contractors. And they find that Jaeger features of speed, efficiency and low cost operation and maintenance give Jaeger operators a recognized advantage in serving this market PROFITABLY.



HIGH REAR LIFT ATTACHMENT—75% More Spouting Area!

Jaeger Service is Complete—Truck Mixers, Agitators, Bins, Batchers, Tipple Tanks—Get Our Catalog and Prices Before You Buy!

THE JAEGER MACHINE CO.
602 Dublin Avenue
Columbus, Ohio

World's Largest Makers of Concrete Mixing Equipment.

JAEGER TRUCK MIXERS

BUILT IN 1 - 1½ - 2 - 3 - 4 - 5 CU. YD. SIZES—END OR SIDE DISCHARGE

Wherever Traction Counts, You Can Count on Thornton Drive

THORNTON FOUR REAR WHEEL DRIVE

"Delivers the Goods" without help

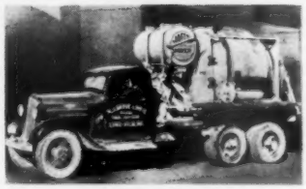
Your payloads are restricted in yardage by the extent of the ability of your trucks to pull through the *worst section* of the hauling route—which is often only a very short portion of the entire trip. When ordinary heavy trucks with single driving axles leave the pavement and hit a soft spot their limited rim-pull, limited flotation and limited traction often fail in the pinch, and there you are, stalled, losing time and money, until help arrives.

A standard 1½-ton truck, such as Ford or Chevrolet, with inbuilt Thornton Four Rear Wheel Drive, will pull through the soft stuff that "stumps" the big fellows, make more trips per day, handle more yards, and cost less to operate.

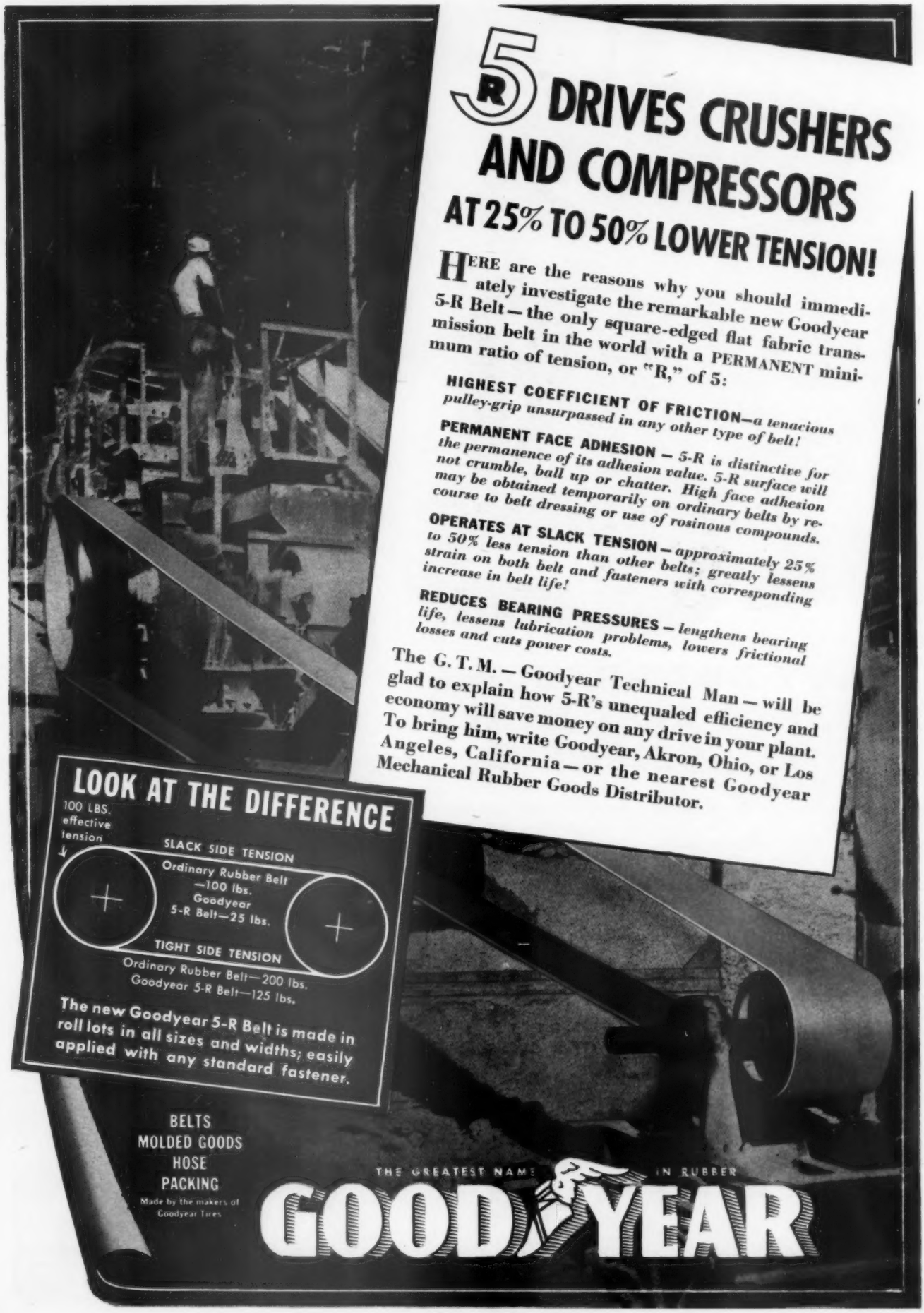
Thornton Drive includes dual ratio gears that give eight forward speeds—two reverse; final gear ratio 87 to 1; dual driving axles; wheelbases, 142″ to 207″, accommodating bodies 8 to 20 feet long; added frame channels 7½ inches deep; massive, dual springs with "walking beam" action.

Write today for complete information. Mention make of chassis you prefer, and intended body length. We can help you save 30 per cent to 50 per cent in first cost and perhaps as much as 60 per cent in operating expense.

THORNTON TANDEM COMPANY
5143 BRADEN STREET • DETROIT, MICHIGAN



Get Aboard the '37 Ready Mix Swing to Thornton Drive


5-R DRIVES CRUSHERS AND COMPRESSORS AT 25% TO 50% LOWER TENSION!
HERE are the reasons why you should immediately investigate the remarkable new Goodyear 5-R Belt — the only square-edged flat fabric transmission belt in the world with a PERMANENT minimum ratio of tension, or "R," of 5:
HIGHEST COEFFICIENT OF FRICTION—a tenacious pulley-grip unsurpassed in any other type of belt!
PERMANENT FACE ADHESION — 5-R is distinctive for the permanence of its adhesion value. 5-R surface will not crumble, ball up or chatter. High face adhesion may be obtained temporarily on ordinary belts by recourse to belt dressing or use of rosinous compounds.
OPERATES AT SLACK TENSION — approximately 25% to 50% less tension than other belts; greatly lessens strain on both belt and fasteners with corresponding increase in belt life!
REDUCES BEARING PRESSURES — lengthens bearing life, lessens lubrication problems, lowers frictional losses and cuts power costs.
The G. T. M. — Goodyear Technical Man — will be glad to explain how 5-R's unequaled efficiency and economy will save money on any drive in your plant. To bring him, write Goodyear, Akron, Ohio, or Los Angeles, California — or the nearest Goodyear Mechanical Rubber Goods Distributor.
LOOK AT THE DIFFERENCE
100 LBS. effective tension
SLACK SIDE TENSION
Ordinary Rubber Belt —100 lbs.
Goodyear 5-R Belt—25 lbs.
TIGHT SIDE TENSION
Ordinary Rubber Belt—200 lbs.
Goodyear 5-R Belt—125 lbs.
The new Goodyear 5-R Belt is made in roll lots in all sizes and widths; easily applied with any standard fastener.
BELTS
MOLDED GOODS
HOSE
PACKING
Made by the makers of Goodyear Tires
THE GREATEST NAME IN RUBBER
GOODYEAR

Model 99 Hug Quarry Special. Designed for heavy duty quarry service; with 10-yard Hug Quarry Body—36,000 lbs. pay load capacity.

HEAVY DUTY HAULING DEMANDS REAL HEAVY DUTY EQUIPMENT

Contractors, quarry operators, dirt movers, in fact the entire field of heavy dump truck movers, recognize the superior features of Hug transportation equipment, because Hug offers a *real heavy duty transportation unit.*

Hugs are built throughout with extra heavy duty truck units, including massive arc welded I-beam frames, powerful heavy duty truck engines, rugged axles, transmissions, and springs. All the way through, Hugs are completely designed to operate profitably on the toughest jobs.

Hug Roadbuilder chassis and dump bodies are engineered and built as a completely balanced, integral unit. This heavy duty construction, balanced load distribution, short wheel base and turning radius together with Hug special features of design puts Hug in a heavy duty hauling class by itself.

Bring your transportation problems to Hug, for whatever your requirements there is a Hug unit that will lick them *profitably.* Let Hug engineers show you *why* the superior transportation features of Hug Roadbuilders will greatly reduce your hauling costs.

THE HUG COMPANY

501 Cypress Street HIGHLAND, ILL.

Model 87Q Hug Roadbuilder. Equipped with 6-yard Hug Scoop End Body and high dumping angle hoist, especially engineered for dirt and rock hauling.

Model 87Q Hug Roadbuilder. With 6-yard Easton Phoenix Side Dumping Quarry Body. Designed particularly for quarry service.

Model 97L Hug Roadbuilder. Equipped with 8-yard Hug Rock Body and down-folding tail gate — for dirt and quarry operations.

BUILT TO MEET A CONDITION

Rex GIVES YOU A Year 'Round Market

FOR YOUR SAND, GRAVEL, STONE AND CEMENT

GET STEADY TURNOVER WITH REX MOTO-MIXERS

Cement and aggregate dealers, all over the country, are turning to Rex Modern Mixers and Agitators with the Modern Cone End Drum as the profitable way to merchandise their concrete materials.

Less than a year ago, the Builders and Industrial Supplies, Inc., of Toledo, Ohio, purchased three Rex Moto-Mixers. A little later, owing to the rapid growth of their ready-mixed concrete business, they purchased two more. Now all five of these machines are kept busy in supplying the demand for ready-mixed concrete in and around Toledo.

Rex Moto-Mixers, with their new, lightweight construction, are giving them more and bigger pay loads per day. They are giving lower ton-mile cost—larger daily profit.

Investigate the Rex Way to higher profits in the aggregate and cement industry.

READY-MIXED CONCRETE

Send today for a copy of the book, "Rex Moto-Mixers and Agitators." It describes the modern way to secure the profitable method of selling cement and aggregates. It illustrates the modern features of the Rex Moto-Mixers.

CHAIN BELT COMPANY
1646 W. Bruce St. Milwaukee, Wis.

REX The Up-to-date Method of Handling Concrete

Moto-Mixers

CHAIN BELT COMPANY *of Milwaukee*

"If preformed wire rope lends itself best to your operations: —

Form-Set"

WILLIAMSPORT'S METHOD OF PREFORMING

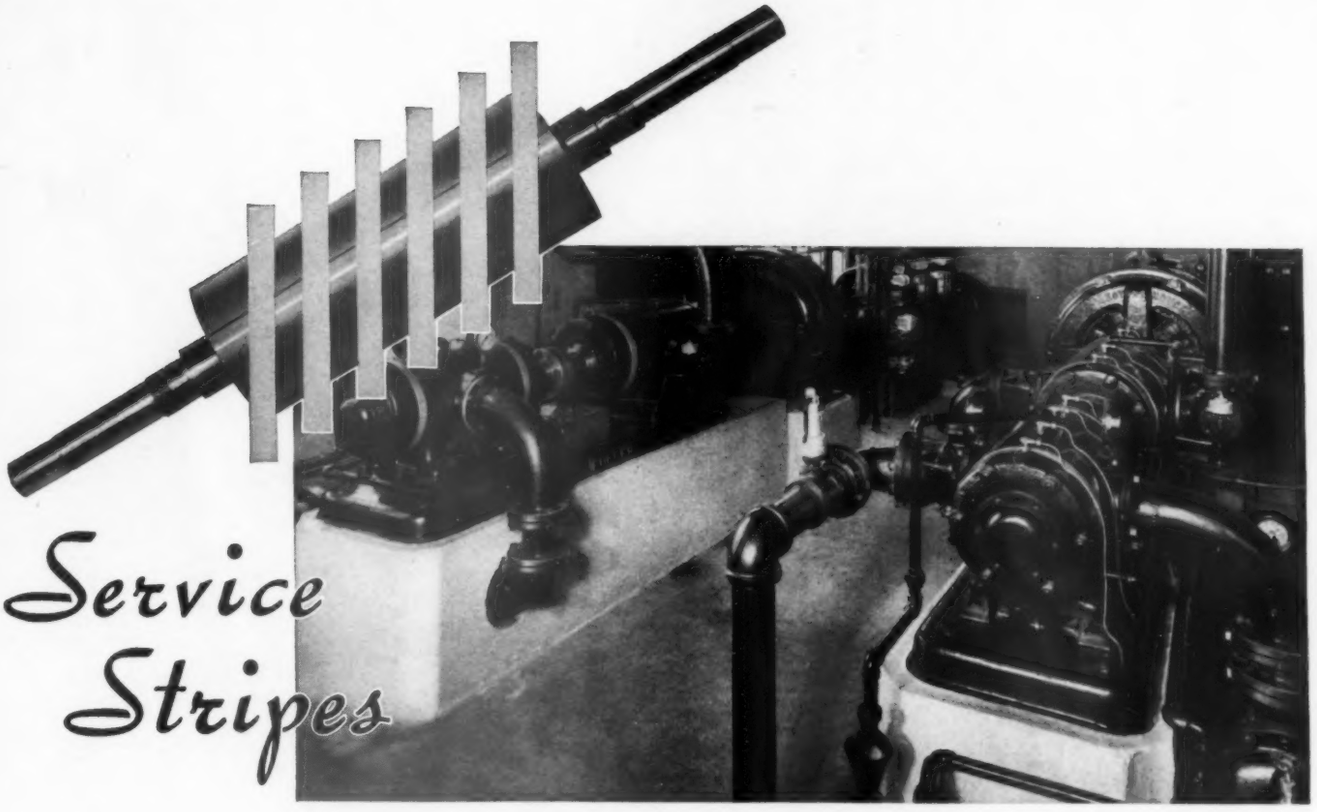
will serve you with greater economy.

Where your work calls for the utmost quality in rope — solid strength and easy handling — it calls for Purple Strand "Form-Set." This top-notch rope is preformed by our own method, to handle your hardest work and give uniform longer service . . . to save you money!

WILLIAMSPORT WIRE ROPE CO.

Williamsport, Pa. 122 So. Michigan Ave., Chicago, Ill.

Other Offices in All Principal Cities



Service Stripes

for Two Fuller Rotary Compressors

in their sixth year of front line duty without repairs or replacements.

TWO machines with a remarkable record . . . especially so, when you know they have been in service in a cement plant . . . about the toughest and most gruelling work a compressor can be subjected to. Day and night, for the past six years, these Fuller Rotary Compressors have hummed along doing their duty without a hitch. How does this check with the operation of your compressor equipment for a similar period?

There's really nothing unusual about some of the records being established by Fuller Rotary Compressors . . . hundreds of installations are in daily operation and giving perfect satisfaction. They're built to do this . . . for every dollar spent the customer receives value plus . . . every machine is built to give service over a long period of years at minimum expense.

For further detailed information write us for Bulletin C3-A

FULLER COMPANY
CATASAUQUA, PENNSYLVANIA
Chicago: 1118 Marquette Bldg.
San Francisco: 320-321 Chancery Bldg.

C-18

FULLER-KINYON FLUXO, AND AIRVEYOR CONVEYING SYSTEMS · · · ROTARY FEEDERS AND DISCHARGE GATES
ROTARY AIR COMPRESSORS AND VACUUM PUMPS · · · AUTOMATIC BATCH WEIGHERS · · · BIN SIGNALS

WITH this speedy, powerful 17-B, Bucyrus-Erie adds a new 1937 ½-yard machine to its world-famous complete line of modern excavators.

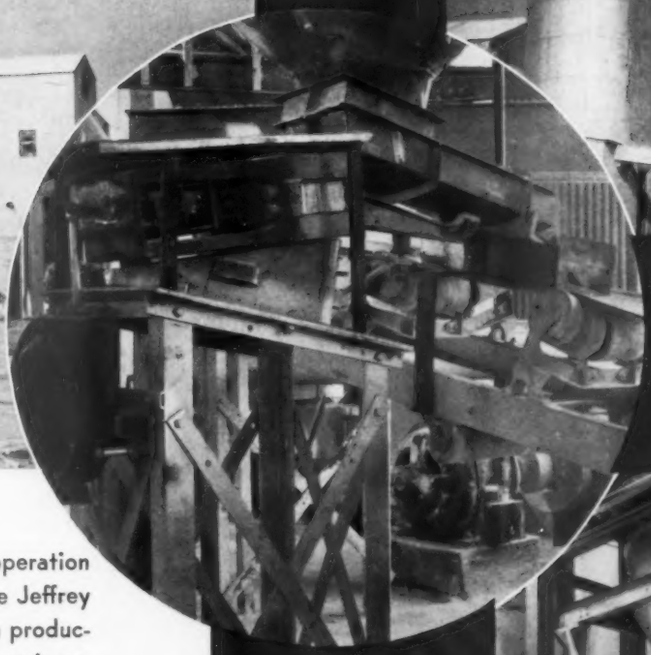
This completely new machine is designed along the same lines as the world's fastest selling ⅜-yard 10-B. It offers you the same important features of fast digging and fast swinging, high-speed travel and easy maneuverability, compact design, husky power, and accurate control.

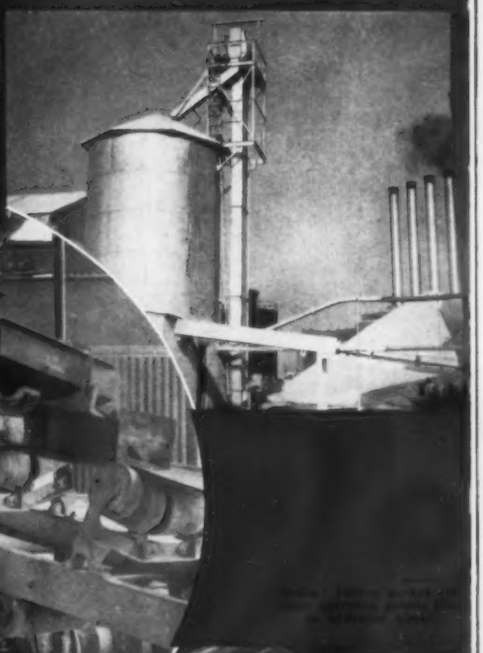
Write today for full information on this new ½-yard winner!

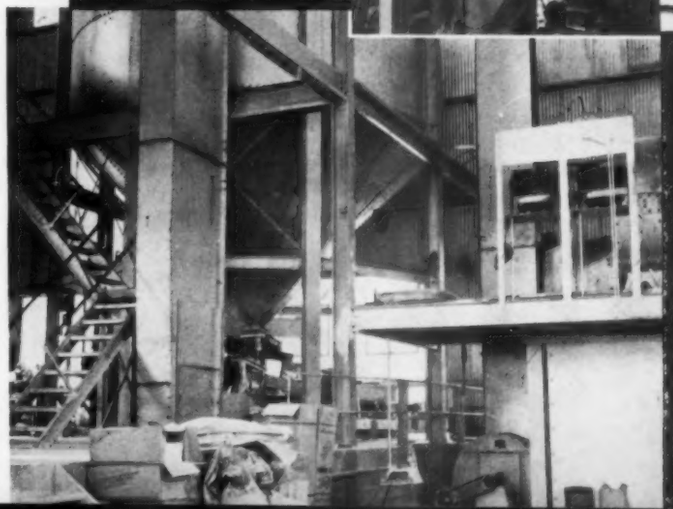
BUCYRUS-ERIE

EXCAVATING, DRILLING, AND MATERIAL HANDLING EQUIPMENT... SOUTH MILWAUKEE, WISCONSIN, U. S. A.

Jeffrey AGAIN ANSWERS TO THE ROLLCALL OF Achievement







When the new Belle Isle lime plant went into operation last October, it marked another instance where Jeffrey equipment became the control units in modern production . . . where Jeffrey experience and design is reflected in greater efficiency and economy of operation. This new plant in Detroit, designed to burn lime at high capacity and low fuel ratio, requires accurate control of materials flowing through it. Jeffrey-Traylor electric vibrating feeders at four key points in the plant effected the desired result.

Remote control from a central point gives the operator complete command of the various processes at these four important points. The result is uninterrupted production of a uniform quality of finished product.

This is another example of the advantages of Jeffrey processing and handling equipment, and Jeffrey plant engineering which covers the entire stone products industry . . . sand and gravel, crushed stone and cement.

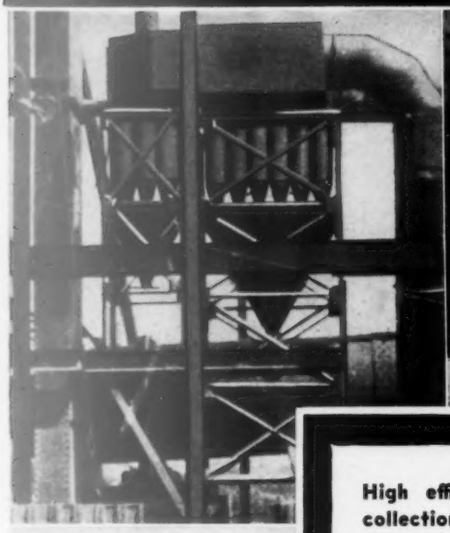
THE JEFFREY MANUFACTURING COMPANY

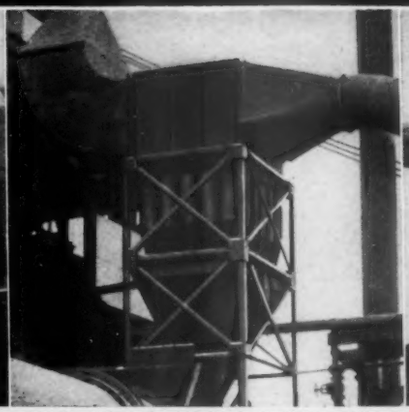
917-99 North Fourth Street, Columbus, Ohio

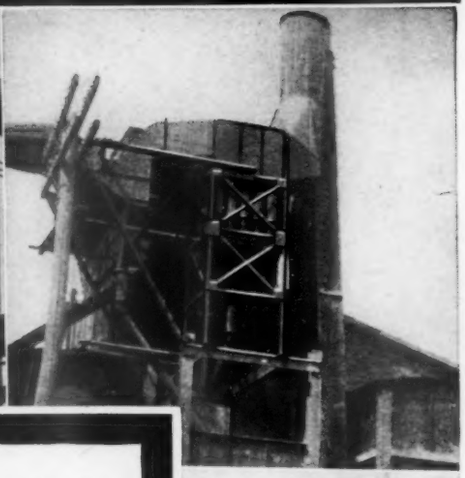
Sales Offices in Principal Cities

1877 60 1937

PROCESS DUSTS





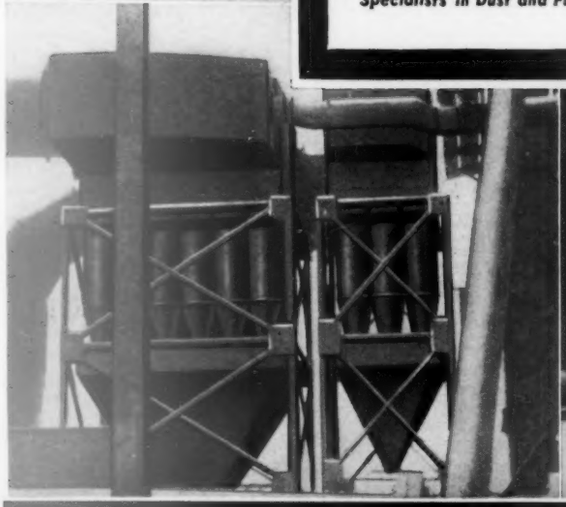


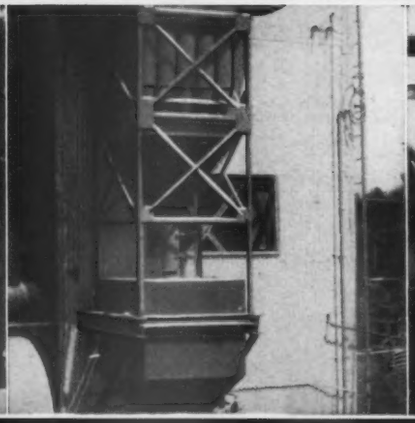
High efficiency is obtained with Multiclones for the collection of dust from kilns, smelters, refineries and other process operations. In the manufacture of powdered products, Multiclones are widely employed because of their simplicity, compactness, reasonable cost, low maintenance expense and adaptability to any volume or capacity.

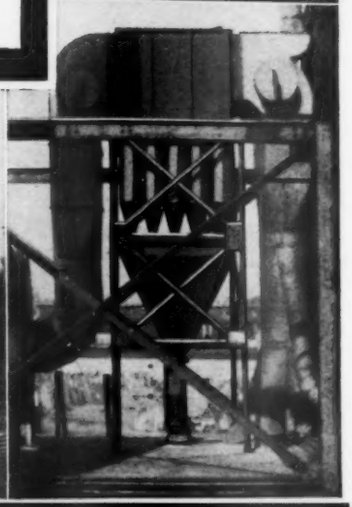
Where unusually large volumes of gas must be handled, at extremely high efficiency, Cottrell Electrical Precipitators are recommended. This type of equipment has been installed in most of the important plants where the recovery of dust yields commercial values or protects the surroundings. We will be pleased to consider your inquiries.

WESTERN PRECIPITATION CORPORATION

1016 W. 9th St., Los Angeles, Calif. 405 Lexington Ave., New York
Precipitation Co. of Canada, Ltd., Dominion Square Bldg., Montreal
COTTRELL ELECTRICAL PRECIPITATORS . PEEBLES SPRAY DRYERS
Specialists in Dust and Fume Control for more than a quarter century







MULTICLONE

FIGURE THE FUEL

AT 1/4¢ per cubic yard

HERE'S a "Caterpillar" Diesel Engine in a portable power unit putting its "shoulder to the wheel" of a Diamond Iron Works rock crusher and gravel plant near Hopkins, Minnesota. One hundred cubic yards of crushings and screenings roll off the conveyors every hour—*at a fuel cost of only 26c.*

That the Diesel principle offers by far the cheapest power for contracting and industrial uses is universally accepted. That "Caterpillar" engineering has made Diesel power thoroughly dependable has been proved in thousands of installations. Records for long, continuous, repairless operation are numerous. Figures showing extraordinary savings on power costs are plentiful. Find out how this modern power can save *you* money and increase *your* profits. There's a dealer near you—with factory-trained service men and stocks of machines and parts.

FIVE "CATERPILLAR" DIESEL ENGINE SIZES—44 HP. TO 160 HP.

CATERPILLAR DIESEL ENGINES

REG. U. S. PAT. OFF.

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

WORLD'S LARGEST MANUFACTURER OF DIESEL ENGINES

Order This Book...and Discard Your Old "Prospect List"

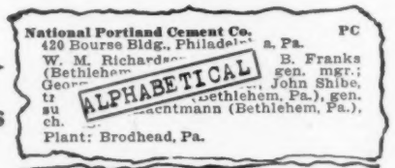
The 1937 Directory section of Pit and Quarry HANDBOOK is the most complete ever published. It is up to the minute—as modern as skill and money can make it. It's checked and double checked.

It gives you the names of the companies, their officers, the number and locations of plants, their capacities and equipment, and the names of the men who buy.

The technical section gives the latest production methods and practices. And there are consolidated catalogs of equipment.

It's Alphabetical

By Company Names →


National Portland Cement Co. PC
420 Bourse Bldg., Philadel[illegible]a, Pa.
W. M. Richards[illegible] B. Franks
(Bethleh[illegible] gen. mgr.;
Geor[illegible], John Shibe,
tr[illegible]Bethlehem, Pa.), gen.
su[illegible]achtmann (Bethlehem, Pa.),
ch[illegible]
Plant: Brodhead, Pa.
ALPHABETICAL

It's Geographical

By Plant Locations →

BRODHEAD Northampton
(P. O. Bethlehem.)
National Portland Cement Co. PC
Branch of Philadelphia, Pa.
Plant Executives: H. [illegible]vendel, supt.; A. P. Hachtmann[illegible], Franks, v.-pres., gen[illegible]ipment.
Pro[illegible] Capacity: Portland ce[illegible]
Na[illegible] Deposit: Limestone. Stripping: Shovel. Drilling and Blasting: Blast hole drills. Digging and Loading: 2 P. & H. 2-cu. yd. electric shovels. Delivery to
GEOGRAPHICAL

Hundreds of New Listings . . . Others Checked for Accuracy

Out this month, the thirtieth edition of the Handbook will be of greatest benefit to those who order promptly and receive their copy from the first printed run. Use coupon below. Select either the complete Handbook *and* Directory, or the convenient Directory alone in smaller, flexible binding. The price is the same in either case.

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Pit and Quarry,
538 S. Clark St., Chicago, Ill. Date.....

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Company .....

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HAISS **Truck Loading News** ★★★★★

Recording the 45th Year of Building Equipment of Demonstrable Superiority

EARLY SPRING · 1937 . . . . . AN ACTIVE CONSTRUCTION YEAR

NEW "135" LOADER

BREAKS ALL SPEED LOADING RECORDS

Up to 8 Yards a Minute in Handling Crushed Stone

The Haiss "135," without getting out of the price range of a loader-type machine, competes in capacity with BIG equipment. It fills the need of the quarryman, sand pit operator or contractor who wants to dispatch big trucks FAST. Like all Haiss high-powered Loaders it has a locomotive rather than a truck-type transmission, with heavy, broad faced gears to carry the power load of its 46 H.P. Gasoline motor or Waukesha-Hesselmann Oil Engine drive.

The "135" is built to meet all the strains its big capacity and high loading rate entail. It is the heaviest and strongest as well as the fastest Loader built.

The Haiss-patented long combination of worm-driven slow crowding speed working with a revolving paddle self-feeding device is available in its most efficient form on the "135" and other heavy duty Haiss Loaders.

Whatever your present truck loading equipment, you owe yourself a reading of the "135" Bulletin.

* * * *

1937 Improvements Give Super-Strength to Hi-Power Bucket

We're proud of the 1937 Hi-Power line—and after 44 years of bucket building we know what it's all about. We'd like nothing better than to sell you a Haiss Hi-Power for a job that's been tough on the best bucket you've ever owned. The Hi-Power's performance will make you a booster for Haiss. You'll tell others about your discovery—and our bucket business will grow.

Or, if you'd rather take someone else's word for it, we'd like to give you a list of recent purchasers. They'll be our best salesmen. Clip the coupon—and get acquainted with a REAL digging bucket.

"I Want a Loader that Will Stand Up," Says This Man

As with a lot of others, it's going to take first hand acquaintance with a HAISS Loader to give him a real understanding of how many hundreds of thousands of yards a Loader should handle—and with how little upkeep. One cent a yard for maintenance is a liberal allowance—and we're quoting the experience of many users who have kept records on Haiss machines through ten years and more of continuous service. A Haiss Loader of any age has the highest resale value of any machine of its class. Doesn't that tell the story? For low cost per yard handled, over a long lifetime, you can't beat a Haiss!

GEORGE HAISS MANUFACTURING CO., INC.
142nd St. and Rider Ave., New York

Please send me your latest catalogs on the Loaders checked:

- ☐ **Model 135 — 5 to 8 yds. per min.**
- ☐ **Model 80 — 3 to 5 " " "**
- ☐ **Model 27 — 2 to 3 " " "**

Send me also your catalogs on:

- ☐ **Hi-Power Clamshell Buckets for Excavating**
- ☐ **Haiss Portable Belt Conveyors**

Name .....

Street .....

City .....

QUARRY AFTER QUARRY IS SWINGING TO NITRAMON

Why? Because Nitramon gives lower cost per ton of rock moved . . . and is safer

DU PONT
REG. U. S. PAT. OFF.

E. I. DU PONT DE NEMOURS & COMPANY, INC., EXPLOSIVES DEPARTMENT, WILMINGTON, DEL.

NITRAMON
REG. U. S. PAT. OFF.
THE APPROVED BLASTING MATERIAL

LIMA

DEPENDABLE
ECONOMICAL
LONG LIVED

type 1001-A WIDE RANGE dragline

follow the trend

LIMA LOCOMOTIVE WORKS, Incorporated
LIMA, OHIO, U. S. A.
SHOVEL and CRANE DIVISION

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LOS ANGELES 2001 Santa Fe Avenue
SAN FRANCISCO 200 Bush Street
DALLAS 1304 McKinney Avenue
MEMPHIS 77 McCall Street
The General Supply Co. of Canada, Ltd. Ottawa, Ont.
Tyee Machinery Company, Ltd. Vancouver, B. C.

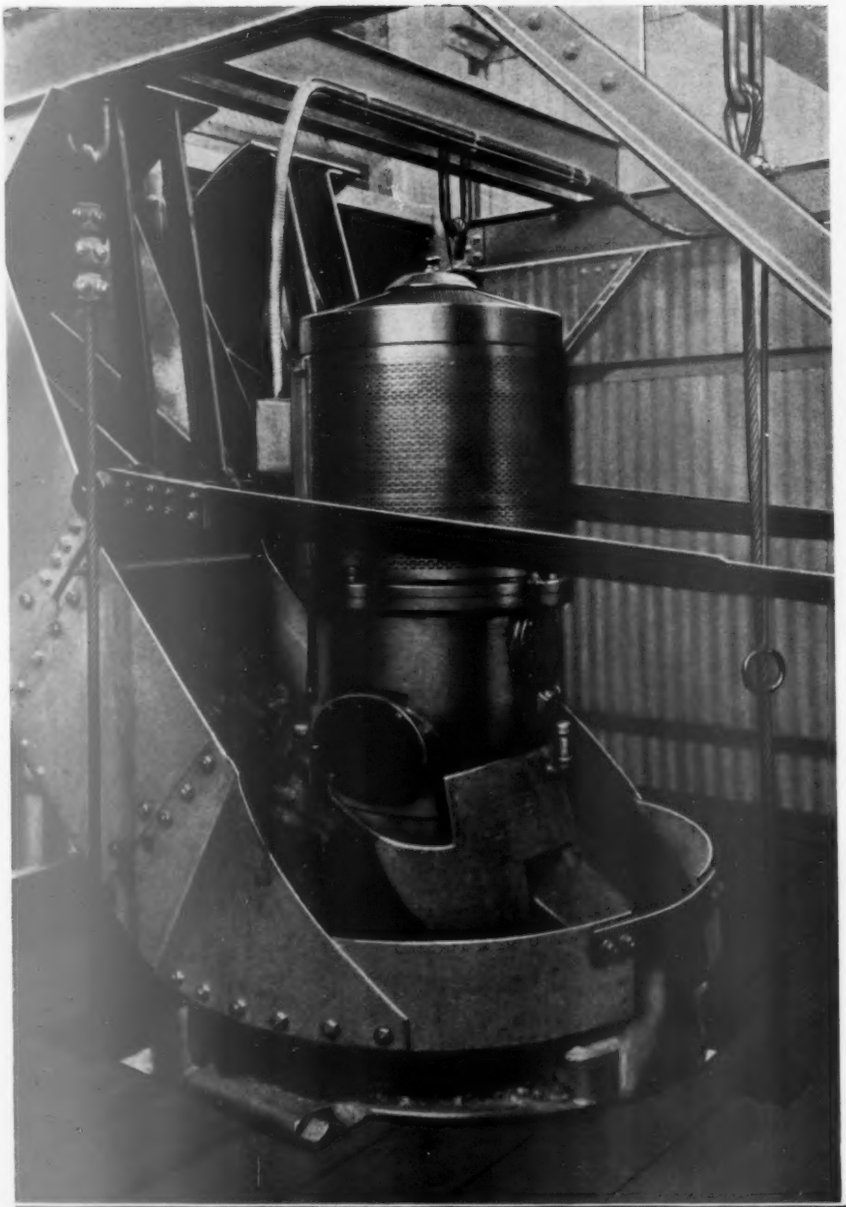
The Type 1001-A dragline is not just another excavator adapted to dragline work. Right from the start it was designed as an efficient, wide range machine embodying certain exclusive LIMA features which make dragline work more profitable.

Operators like its ease of operation and the way it handles long booms at low angles. Contractors like its economical and trouble-free performance. A LIMA Type 1001-A dragline is your assurance of long, profitable and efficient service.

Write for a copy of bulletin No. 11-A.

SHOVELS — DRAGLINES — CRANES — CLAMSHELLS

Proven
BY EVERY TEST



A PROMINENT Ohio commercial stone plant made the following tests on an Allis-Chalmers Newhouse Crusher, to prove to their own satisfaction that they had selected the best crusher for their job.

A test, which was of long duration was made on a 10″ Newhouse Crusher driven by a 125 hp, 495 rpm motor. The setting was 9/16″ on the close side with a ½″ throw eccentric. The maximum power input to the motor was 100 hp.

All of the material crushed was passed over two 4′x8′ vibrating screens, set in tandem, with ½″ square openings. This gave a product through this ½″ screen cloth and washed over an ⅛″ square wire which averaged 43 tons an hour for duration of test. This material discharged into a bin by itself and was weighed. The oversize and throughs averaged about an equal amount. This would bring the total material handled to approximately 86 tons an hour.

The feed to the crusher during the test was minus 5″ plus 2″. The product discharged from the 10″ Newhouse contained over 98% of material minus 1″ and only 6% of fines—⅛″ indicating very little dust.

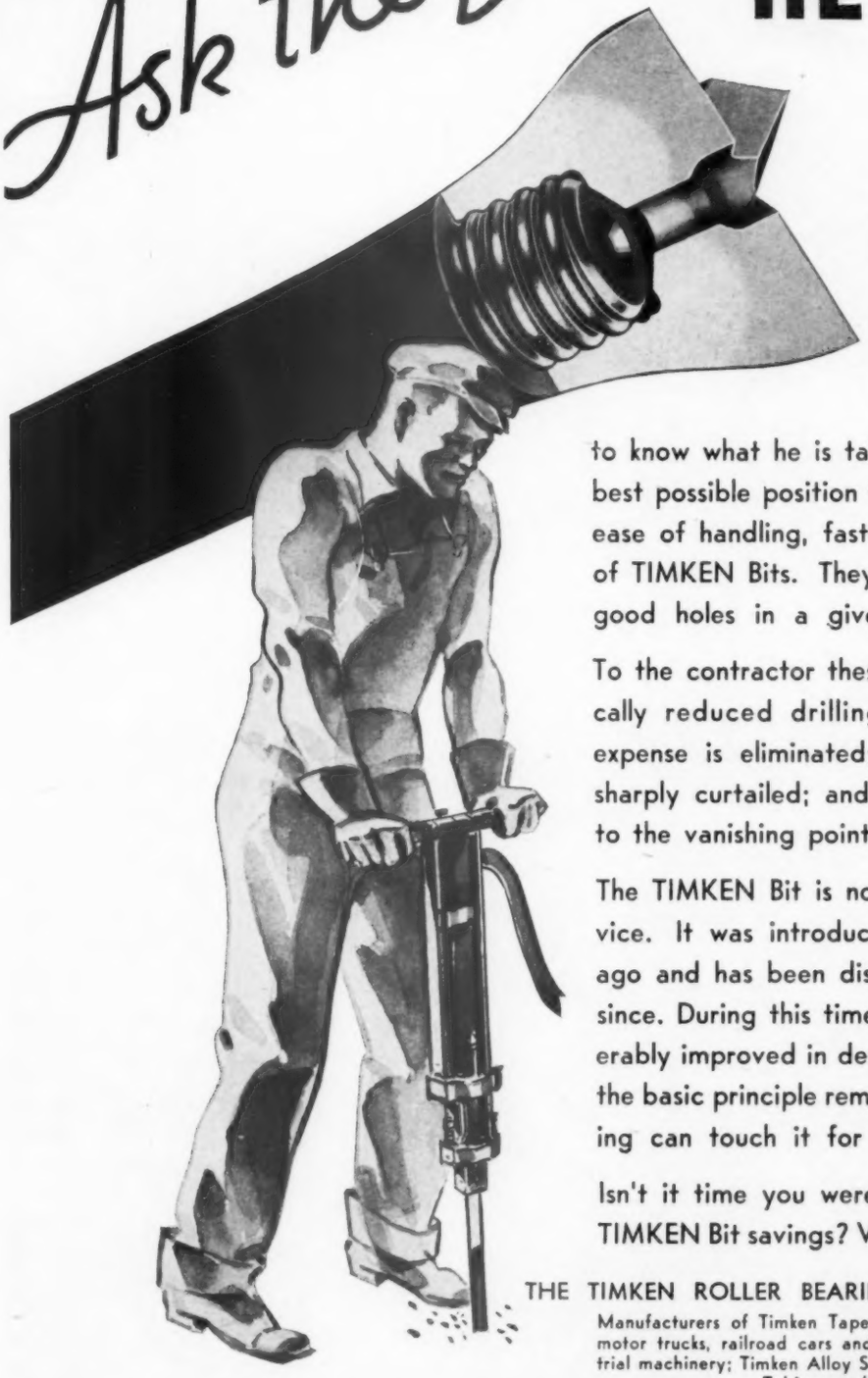
EQUIPMENT ENGINEERS TO INDUSTRY

ALLIS·CHALMERS

MILWAUKEE WISCONSIN

Ask the Driller

HE KNOWS



Any rock driller who has had experience with both will tell you that TIMKEN Bits have it over forged steel "like a tent"

After all, the driller ought to know what he is talking about He is in the best possible position to appreciate the greater ease of handling, faster drilling and longer life of TIMKEN Bits. They enable him to get more good holes in a given time with less effort.

To the contractor these advantages mean radically reduced drilling costs — for all forging expense is eliminated; drill steel investment is sharply curtailed; and nipping charges are cut to the vanishing point.

The TIMKEN Bit is not a new or unproved device. It was introduced more than four years ago and has been displacing forged steel ever since. During this time the bit has been considerably improved in design and material although the basic principle remains the same. Today nothing can touch it for efficiency and economy.

Isn't it time you were getting acquainted with TIMKEN Bit savings? Write for more information.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.

TIMKEN BITS

KOEHRING

FASTER *with* FLOW-LINE DISCHARGE

FLOW-LINE

—means speedy and full chute discharge for Koehring 28-S, 56-S and 84-S Concrete Mixers used for central mixing plants and large volume concrete construction jobs. The Flow-Line discharge permits a natural flow of concrete, reduces abrasive wear, causes a minimum of segregation—decreases discharge time.

KOEHRING HEAVY DUTY

KOEHRING COMPANY

Pavers · Mixers · Shovels · Cranes · Draglines · Dumptors · Mud-Jacks

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REJECTED!
SORRY - BUT THAT ROCK IS ALL REJECTED
WHAT'S WRONG WITH IT?
OUR SPECIFICATIONS CALL FOR 100% PASSING 3/4" AND 50-65% PASSING 1/4" THIS ROCK TESTS ONLY 33% PASSING 1/4"!
THAT'S NOT MY FAULT THE CRUSHER WON'T PRODUCE IT.
FRED CONNORS IS DOING IT EVERY DAY GO ON OVER AND SEE WHAT HE IS USING
IF THERE IS A CRUSHER BUILT THAT WILL PRODUCE ROCK TO MEET THOSE SPECIFICATIONS I WANT TO SEE IT.
SAY FRED, WHAT KIND OF A CRUSHER HAVE YOU GOT THAT MEETS THE SPECIFICATIONS FOR THIS OIL ROCK?
I HAVE A PIONEER 40X20 ROLL CRUSHER. PIONEER ANALIZED MY JOB AND DESIGNED AND BUILT A STEP-TOOTH SHELL FOR JUST THIS KIND OF A JOB - HERE'S HOW IT WORKS -
YOU SEE THIS SHELL IS SMOOTH AND THAT ONE HAS A STEP-TOOTH. THE ROLL IS SET TO PRODUCE 3/4" AND THE STEP-TOOTH PRODUCES THE 1/4"
WELL THE STEPS SHOULD GRAB BIGGER ROCKS TOO!
SURE THEY DO AND FURTHERMORE I HAVE PRODUCED 60 TONS AN HOUR AND MET THE SPECIFICATIONS
IT SOUNDS - TOO GOOD TO BE TRUE!!

PIONEER WAS THE FIRST TO OFFER

THE ANTI-FRICTION BEARING ROLL CRUSHER
WITH SMOOTH SHELLS FOR FINE CRUSHING

THE CORRUGATED ROLL SHELL *and*
FOR COARSE ROCK

now THE STEP-TOOTH SHELL!
FOR OIL ROCK

PIONEER GRAVEL EQUIPMENT MFG. CO.
1515 CENTRAL AVENUE · MINNEAPOLIS, MINNESOTA

Pioneer Gravel Equip. Mfg. Co.
1515 Central Avenue
Minneapolis, Minn.

Please tell me more about your Roll Reduction Crusher. My specifications are as follows:

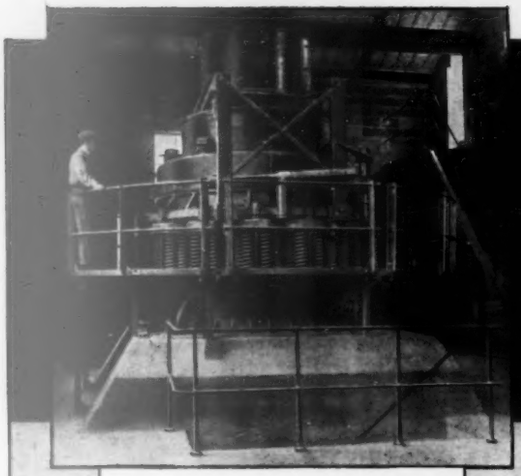
_____

_____

NAME _____

ADDRESS _____

_____



Seven-foot Standard Cone Crusher crushing limestone.

Four-foot Short Head making a very fine limestone product.

CRUSHING and SCREENING

you can depend on SYMONS

WHETHER it is for ordinary reduction crushing or for making the finer products as are in demand today, no piece of crushing equipment is comparable to the Symons Cone. With the two types, Standard and Short Head, any requirement for product or capacity can be met. The Symons Cone is the answer for plants whose reduction crushing equipment is obsolete and no longer capable of profitably producing the sizes required today.

The Symons Screen fills the same need in the field of screening. It sets level and with its different screening action, the problem of accurately sized materials is readily solved. When considering changes in either crushing or screening equipment, see what Nordberg has to offer.

NORDBERG MFG. CO.

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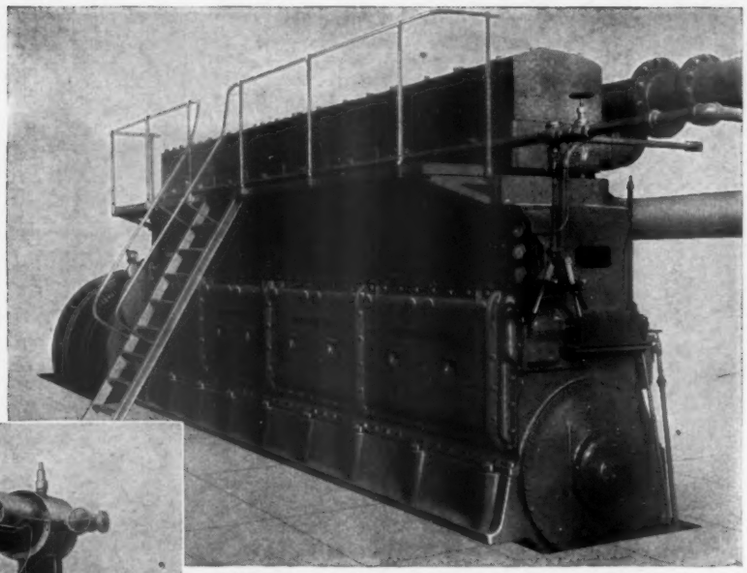
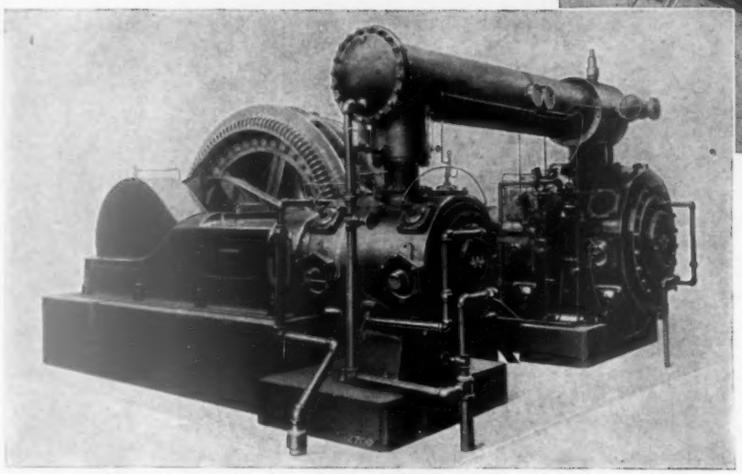
Roebling...
The pacemaker in
wire rope development
THE most exacting basis for judging wire rope performance is AVERAGE SERVICE.
This is the basis advocated by Roebling, in which rope cost per ton of material handled, or per other unit of service measurement, is based not on the service of a single rope but on the *average* service of several ropes.
John A. Roebling's Sons Co.,
Trenton New Jersey
TRADE MARK
JAR
REG. U.S. PAT. OFF.

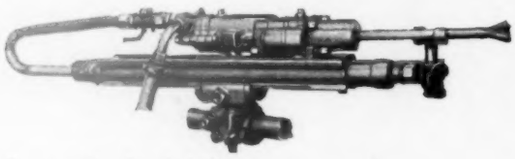
WORTHINGTON EQUIPMENT *for the* ROCK PRODUCTS INDUSTRY



1000-hp. 8-cylinder Diesel engine... totally enclosed. Worthington Diesel sizes range from 25 to 1500 hp. Any type of drive

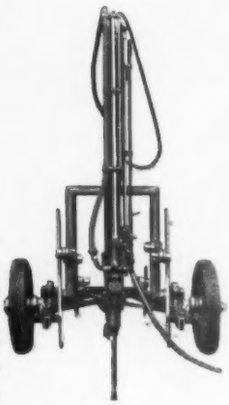


Horizontal duplex air compressor. A complete line... a wide variety of arrangements... for the largest or smallest capacity requirement



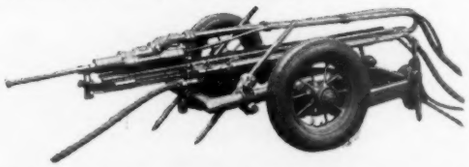
Pneumatic-feed drifter

Screw-feed drifter



The ROCK MASTER... drills at any angle. Steel rims... or pneumatic tires for easy towing

Rock hammer



THE strenuous services encountered in the rock products industry call for equipment of more than ordinary stamina.

The equipment shown here illustrates but a small part of the complete Worthington line... one which has earned an enviable reputation among users for delivering full performance and for standing up under the severest conditions.

Each unit embodies the correct engineering, high-grade materials and careful workmanship for which Worthington is widely known.

To specify Worthington is to be assured of an extra measure of protection against production delays.

ONE MAKER... UNDIVIDED RESPONSIBILITY

● *Literature available*

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C7-7

★ The Lorain-40 carries a full, honest-measure ¾ yd. dipper, yet in weight and price it approximates most ½ yd. machines. Its 50% increased capacity for so little additional investment, plus the fact that it is an efficient, all-purpose unit of 101 cost-cutting, production-speeding uses, explains why it has been so readily accepted in quarries and sand and gravel plants . . . They use them ***for clean-up work,*** where a big shovel is inefficient, slow, expensive . . . ***for stripping,*** replacing the usual cast-off shovel; the investment is no greater, the results are better . . . ***For stock piling,*** material handling, truck loading, bin charging, etc. . . . ***For digging,*** as a shovel or dragline, to meet steady production demands; to "pinch hit" for larger shovels in emergencies, to help meet schedules.

THE UNIVERSAL CRANE CO., LORAIN, OHIO

THEW CENTER DRIVE

LORAINS

MOVE MORE MATERIAL, FASTER AT LOWER COST

CU. 3/8 to 2 YD.

YOU CAN SAVE OPERATING DOLLARS ON WIRE ROPES -

— by Correct Selection

Contractors who have never selected ropes for their machines *scientifically*, will be amazed at the saving that can be accomplished by merely insuring that the *correct* rope is employed for each purpose. Wire Rope design has become a science, and the *correct* rope for the task will give much longer service than the *incorrect* rope.

UNION makes the *correct* rope for every service. Secure the recommendations of our engineers.

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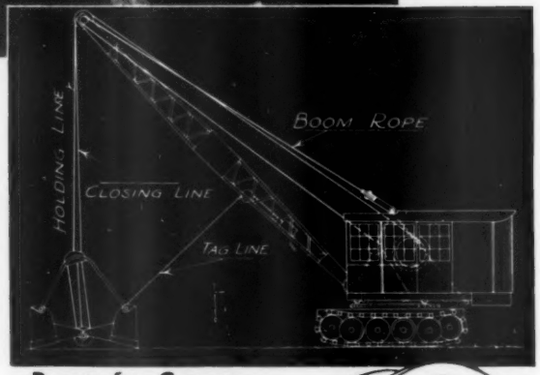
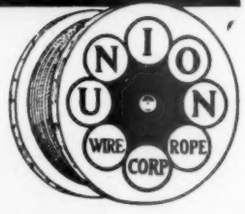
UNION WIRE ROPES

The ULTIMATE LOW COST WIRE ROPE



Ropes for Cranes

Diagram shows the wire ropes used on Cranes. Different makes of machine have different rope requirements. In writing for recommendations give full classification data on each machine.



Another NEW Northwest

MODEL 25

The Fastest 3/4 Yard Shovel Ever Offered!

SPEED—Speed for high output has been the keynote in designing this new Northwest Model 25—¾ yd. shovel.

Fast dipper action, fast swing, simple, easy, responsive control through the well known Northwest "feather-touch" control, power and stability above the ordinary shovel of this capacity, mobility, short tail swing—all combine to increase output beyond the usual expectation for this class and size of machine.

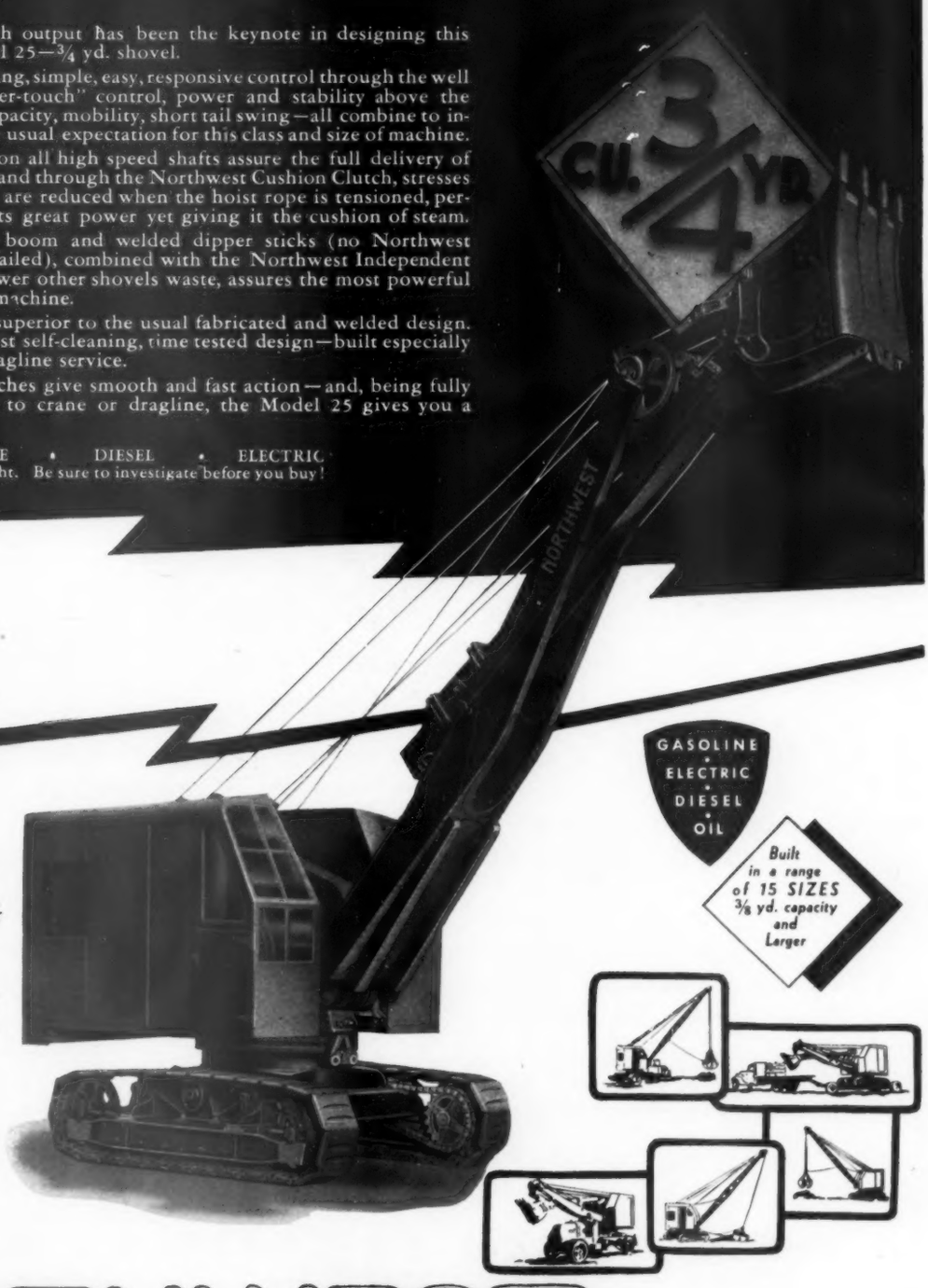
Ball and roller bearings on all high speed shafts assure the full delivery of maximum engine power, and through the Northwest Cushion Clutch, stresses on all parts under power are reduced when the hoist rope is tensioned, permitting the delivery of its great power yet giving it the cushion of steam.

The Northwest welded boom and welded dipper sticks (no Northwest welded boom has ever failed), combined with the Northwest Independent Crowd which utilizes power other shovels waste, assures the most powerful front end on any ¾ yd. machine.

Bases are cast steel, far superior to the usual fabricated and welded design. Crawlers are of Northwest self-cleaning, time tested design—built especially for shovel, crane, and dragline service.

Cone type swinging clutches give smooth and fast action—and, being fully convertible from shovel to crane or dragline, the Model 25 gives you a machine for every job.

GASOLINE • DIESEL • ELECTRIC
Priced Right. Be sure to investigate before you buy!



GASOLINE • ELECTRIC • DIESEL • OIL

Built in a range of 15 SIZES ⅜ yd. capacity and Larger

NORTHWEST ENGINEERING

The world's largest exclusive builders of gasoline, oil, diesel or electric powered shovels, cranes, draglines, pullshovels and skimmers

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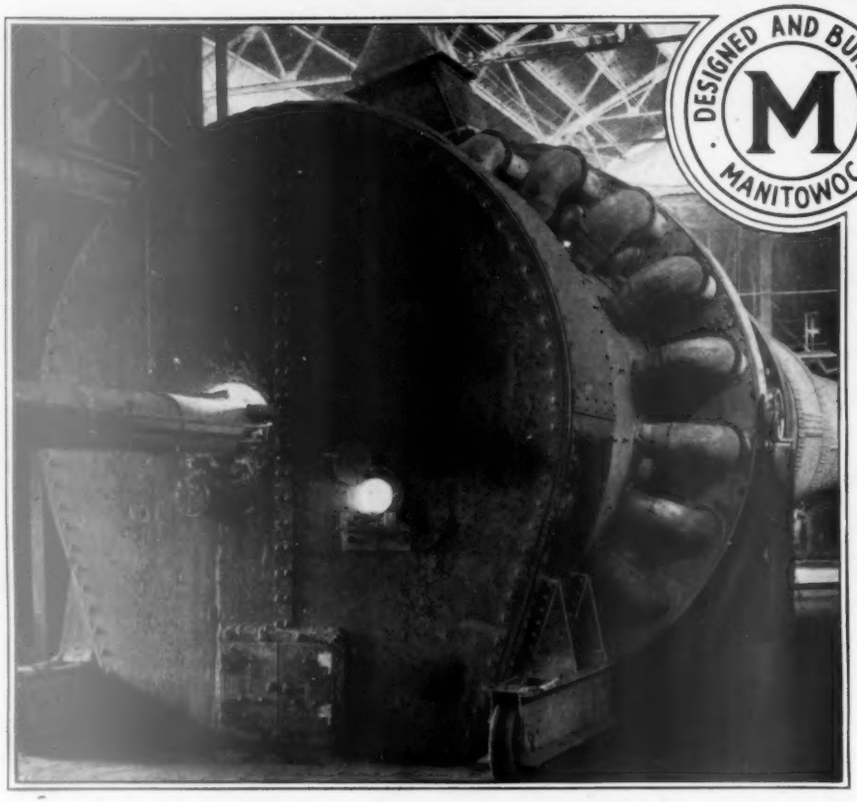
Chicago, Illinois

NORTHWEST

The VANDERWERP RECUPERATOR for Rotary Kilns



10-Ft. Cement Kiln Installation of Type CI Short-Plate Recuperator

insures:

- Improved Quality of Cement
- Better Grindability of Clinker
- Maximum Fuel Economy
- Highest Efficiency of Heat Recovery
- Low Maintenance Cost

«»

"The quality of a cement is in no way dependent upon the absolute quantities of the various constituents, but is regulated by the relationships between them."

Kuhl (Dr. Hans), *Cement Chemistry in Theory and Practice.*

The Vanderwerp Recuperator alone—through rapid air quenching without annealing or slow cooling—establishes these relationships in the most effective manner.

Write—without obligation—for full particulars.

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Division of

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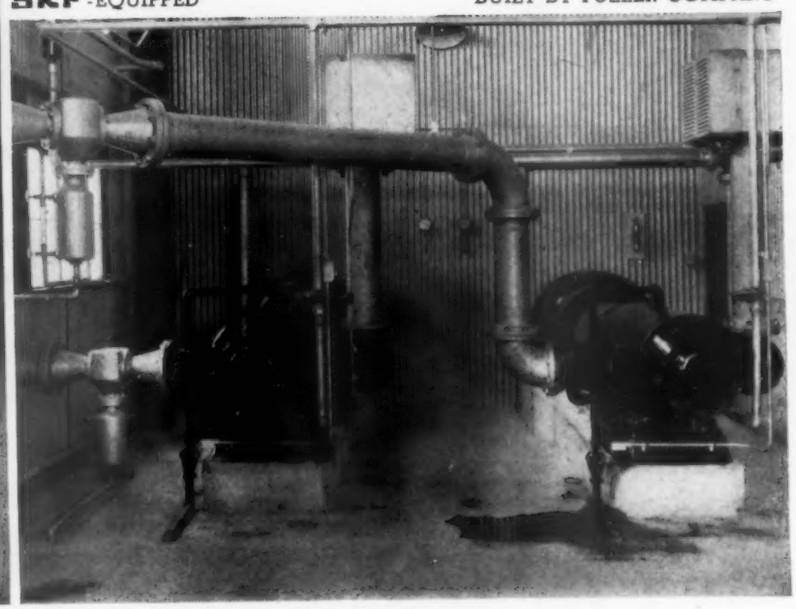
131 E. River St.

SKF-EQUIPPED BUILT BY FULLER COMPANY

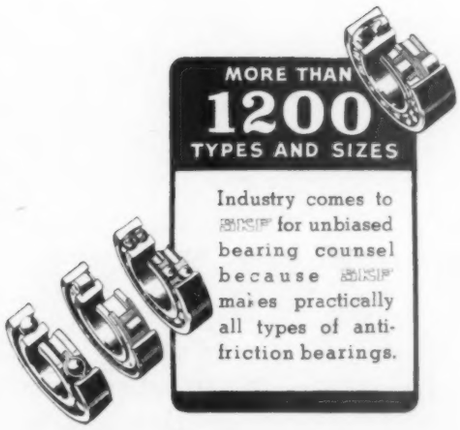


On Rotary Air Compressors, **SKF** *Bearings Help*

PRODUCE 2400 CFM

• 2400 cubic feet per minute . . . that's what these two Fuller Rotary Air Compressors produce for Fuller-Kinyon Pumps used for pumping bulk cement at four Santa Cruz Portland Cement Company unloading stations.

The Fuller Company use SKF Cylindrical Roller Bearings for their compressors because of their dependability, smooth performance and low maintenance costs. If *you* have a place for a bearing, remember this: you can depend on SKF.


MORE THAN
1200
TYPES AND SIZES
Industry comes to SKF for unbiased bearing counsel because SKF makes practically all types of anti-friction bearings.

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3808

SKF

BALL AND ROLLER BEARINGS

"We put an end to crawler troubles when we got this new P&H Pacemaker. It's built for travel—proved for travel—in millions of miles of tractor service." Martin Lewein — shovel operator.

Here's how we get SHOCK ABSORBING ACTION *in these* TRACTOR-TYPE CRAWLERS

● The tractor-type crawlers on the P&H Pacemaker are always kept at proper tension by these compensator springs. There's no slack in the crawler track—none of that jerkiness to cause damage. At the same time, there's ample shock-absorbing action in the springs themselves to protect the crawlers against distortion or breakage. These compensator springs automatically adjust the crawler track for proper action on long or short hauls, in sand and gravel or knee deep in muck. Crawler troubles are a thing of the past on these P&H Pacemakers—one of the features that make them faster on the job.

HARNISCHFEGER CORPORATION
4451 W. National Avenue *Established 1884* Milwaukee, Wisconsin

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CORPORATION
EXCAVATORS ★ ELECTRIC CRANES HOISTS ★ MOTORS ★ ARC WELDERS

The Universal Line is complete: Portable Plants with any arrangement of Crushers, Screens, Conveyors, etc.; Stationary Plants, Jaw Crushers, Roll Crushers, Elevators, Conveyors, Screens, Bins, etc. For ultimate satisfaction, specify Universal!

Stationary or Portable—be sure it's Universal!

More than thirty years of specialized effort — building good crushing equipment — is represented today in every unit of the Universal Line. Portable Plants, Stationary Equipments, Jaw Crushers, Roll Crushers, screens, feeders, bins, elevators, conveyors, and many other accessory equipments. Each unit has been proved by years of field test and is offered by Universal today for effectively reducing your production costs.

ORIGINAL FORCE FEED UNIVERSAL CRUSHER

CRUSHERS
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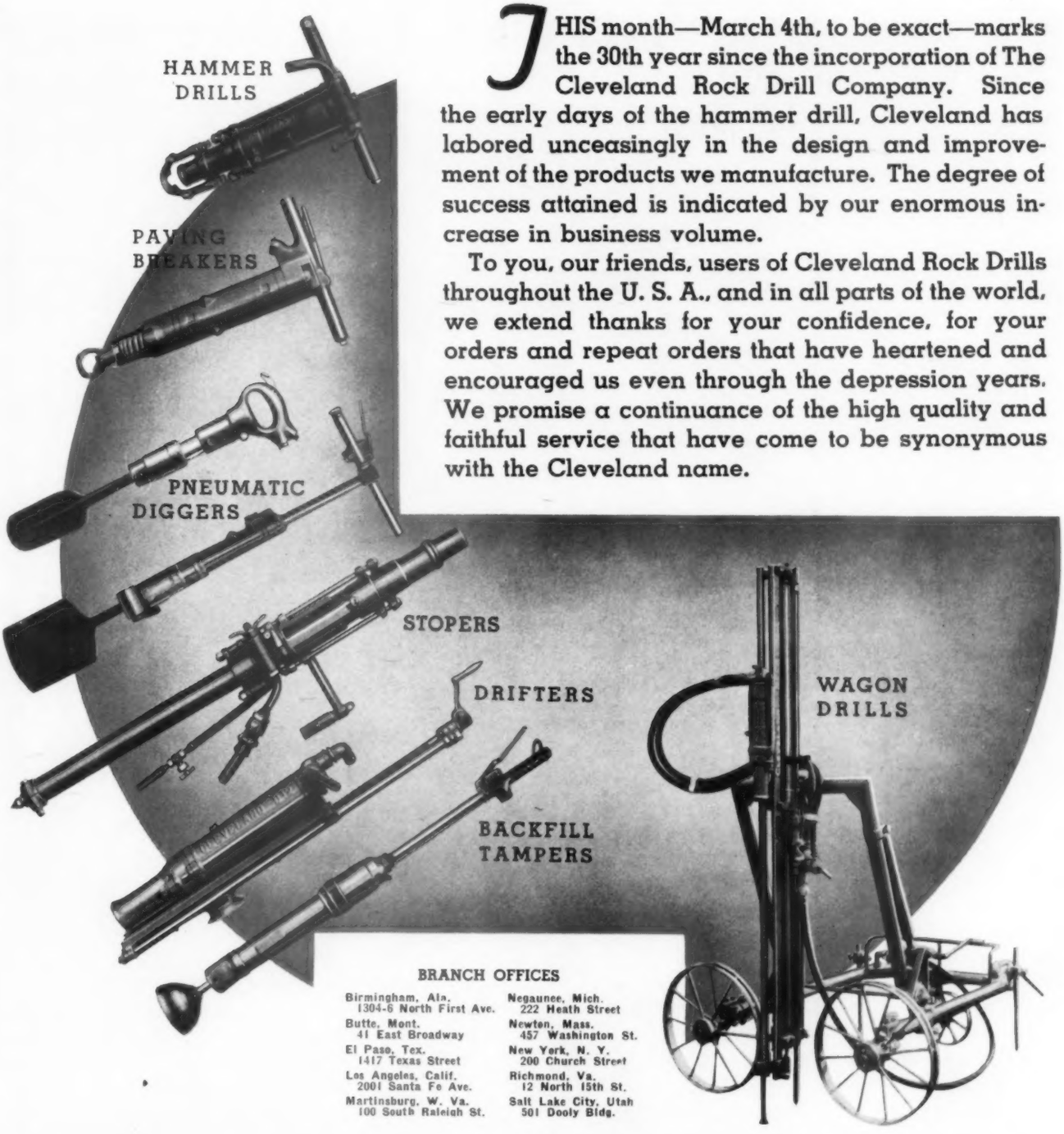

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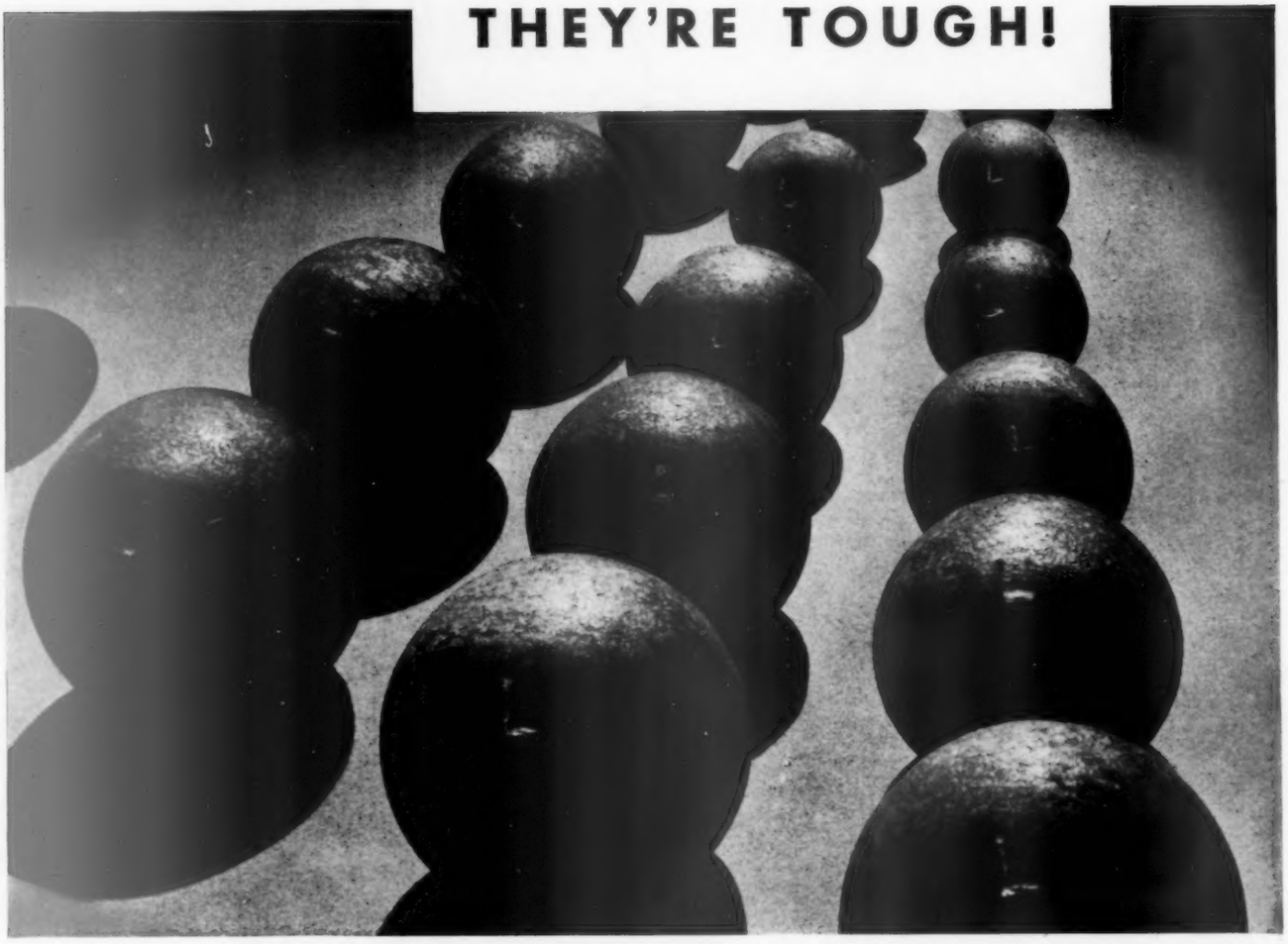

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On the Pebble Rock	17 Tons per Hour	12

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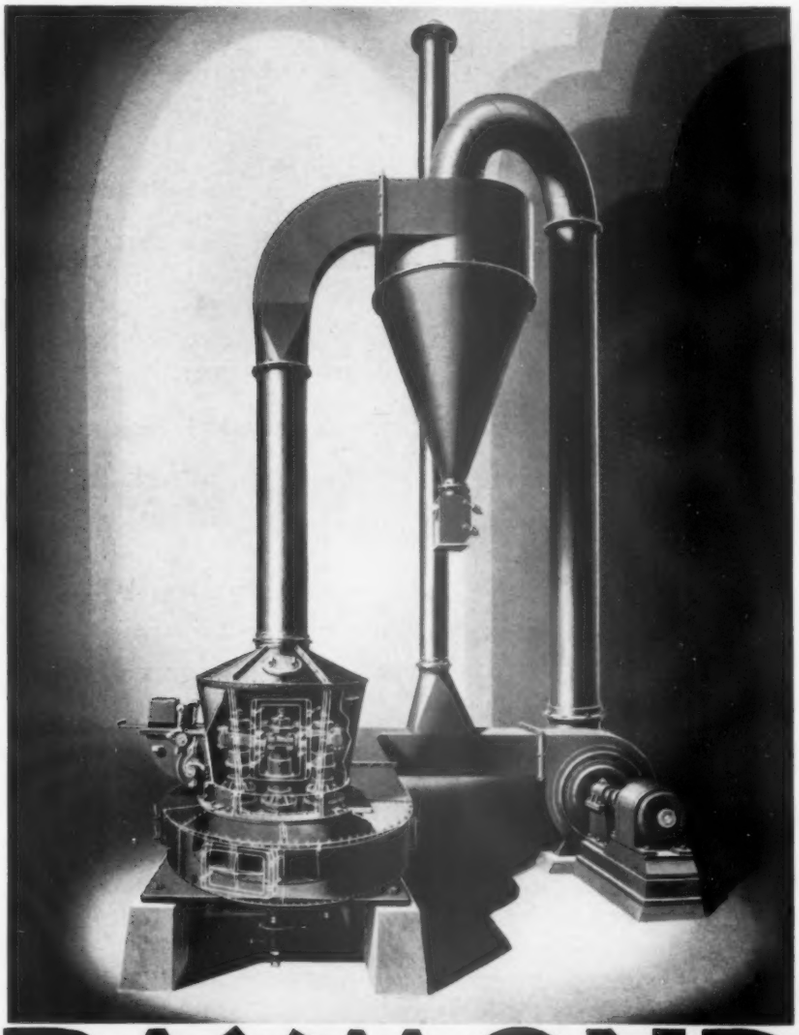

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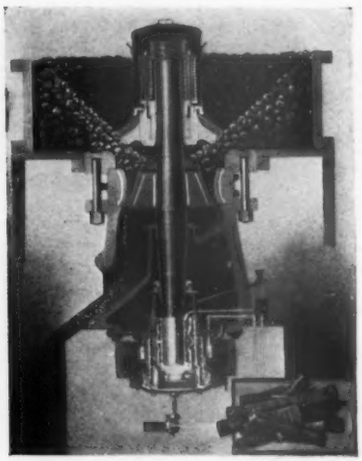

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PLUS	3/4"			7
MINUS	3/4"	PLUS	9/16"	14
MINUS	9/16"	PLUS	3/16"	63
MINUS	3/16"			16

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PIT AND QUARRY

Vol. 29 MARCH, 1937 No. 9

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Published on the tenth of each month for producers and manufacturers of Cement, Crushed Stone, Gypsum, Lime, Sand, Gravel and other nonmetallic minerals. Copyrighted 1937 by Complete Service Publishing Co., 538 South Clark Street, Chicago, Ill.

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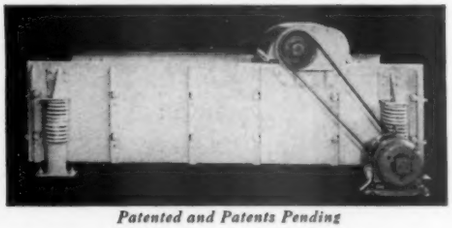

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PIT AND QUARRY

CHICAGO March, 1937

Ahnfelt and Carlson Retire on Pensions

UNIVERSAL ATLAS MAKES CHANGES

Two veterans in the cement industry, John Ahnfelt, operating manager, and A. G. Carlson, chief engineer of the Universal Atlas Cement Co., are retiring under the company's retirement plan. They have been with the company 43 and 34 years, respectively.

Mr. Ahnfelt began his career by making tests of cement at the old North Works of Carnegie-Illinois Steel corporation, Chicago, where the company first made cement. After five years at North Works, he became assistant superintendent at the newly built plant at

A. G. Carlson

John Ahnfelt

South Works (South Chicago) and four years later assistant superintendent of the new and larger plant at Buffington, Ind. In 1908 he was made superintendent and in 1914 general superintendent. In 1919 he became operating manager of all plants.

Mr. Carlson started as designer at the Buffington plant and 22 years ago was appointed chief engineer. Prior to his connection with Universal Atlas he was with the Medusa Portland Cement Co. and designed and built its plant at Syracuse, Ind.

New appointments, effective March 1, were announced by Blaine S. Smith, president, as follows:

O. N. Lindahl, comptroller and secretary; J. J. Heffernan, asst. secretary; Leonard Wesson, operating manager; S. J. Robison, chief engineer; O. L. Moore, director of tests and research; J. C. Witt, manager, research and development; T. A. Hicks, general chemist; G. L. Lindsay, engineer of tests; R. B. Hynes, purchasing agent; E. D. Barry, manager, industrial relations; Gordon C. Huth, asst. manager industrial relations.

January Cement Output Nearly Double Year Ago

The Portland-cement industry in January, 1937, produced 6,633,000 bbl., shipped 4,678,000 bbl. from the mills, and had in stock at the end of the month 24,396,000 bbl. Production and shipments of Portland cement in January, 1937, showed increases of 81.7 and 19.4 per cent., respectively, as compared with January, 1936. Portland-cement stocks at mills were 7.5 per cent. higher than a year ago.

The factory value of the shipments from the mills in 1936—112,566,000 bbl.—is estimated as $170,431,000, representing an average value of $1.51 per bbl.

According to the reports of producers the shipments totals for 1936 include approximately 3,015,000 bbl. of high-early-strength Portland cement with an estimated mill value of $5,769,000.

Mills operated at 30.4 per cent. of capacity in January, 1937, compared with 16.1 per cent. in January, 1936.

★ The Kelley Island Lime & Transport Co., Cleveland, O., is reported to be planning a new crushing and handling plant at Sandusky, O., to cost about $100,000. J. R. Schumacher is the engineer in charge of the proposed improvement.

The Standard Tripoli Co. is completing the erection of a milling and drying plant at Baxter Springs, Kan.

Lime Assn. to Meet in Chicago in May

DIRECTORS, OFFICERS HOLD SESSION

A combined meeting of the Board of Directors and Executive Committee of the National Lime Assn. was held on Jan. 27 and 28 in the Bismarck Hotel, Chicago. Considerable interest was shown in a comprehensive report of the activities of the Association during the first six months of the current fiscal year, which was read by the general manager.

The board authorized the association to expend an amount not to exceed $1,000 to continue fire tests on full-size plaster panels at the National Bureau of Standards, in the event that preliminary tests now being made on small panels, the plaster of which contains asbestos fibre, definitely indicate that they will pass the one-hour rating prescribed by the Board of Fire Underwriters.

On the question of whether or not the association should coöperate with manufacturers of masonry cement in opposing certain requirements of the revised Federal specifications covering that material (SS-C-181a), the board recommended against joint action. It directed that the association continue to promote high-lime-content mortars and to oppose all substitutes for such mortars, also to work directly with the Bureau of Standards in criticizing the masonry-mortar specification.

The recent death of Ralph P. Wilton having created a vacancy in the office of association treasure, the board unanimously elected James H. McNamara, president, Eagle Rock Lime Co., Eagle Rock, Va., to fill that position for the remainder of the present fiscal year.

After considering the recommendation of its convention committee, the board decided to hold the 1937 convention in Chicago, preferably at the Drake Hotel, some time in May.

New Cement Plant at Houston Is Under Way

EQUIPMENT BEING RECONDITIONED

An old cement mill at Hartshorne, Okla., closed for 16 years, is being dismantled by the newly-formed Gulf Portland Cement Co. and usable equipment and materials are being transported to the site of the Gulf company's new plant on the ship channel at Houston, Tex. A small machine shop has been set up at Hartshorne to recondition some of the equipment. Tom B. Douglas, technical manager, is in charge.

Concrete foundations are being placed for the new plant and work is proceeding on the construction of an 86-ft. by 16-ft. wharf on the channel, according to Kent B. Diehl, president.

Lime Producers on West Coast Form Association

Oscar B. Myers has been named manager of the newly organized Western Lime Assn., composed of the principal producers of lime products along the Pacific Coast. Mr. Myers was formerly associated with the Texas Cement Plaster Co. of Kansas City, Mo.

Member companies of the organization are: Auburn Chemical Lime Co., Ltd.; California Chemical Co.; Chubbuck Lime Co.; Henry Cowell Lime & Cement Co.; Diamond Springs Lime Co.; Holmes Lime & Cement Co.; Kingsley Co. of California; Roche Harbor Lime & Cement Co.; United States Lime Products Corp.

Volunteer Expands to Meet Demands of TVA

The Volunteer Portland Cement Co., Knoxville, Tenn., recently increased its production capacity to meet the demands of the reviving building industry and the Tennessee Valley Authority, a government utility which has already expended more than $118,000,000 in dam construction, and which has purchased much of the Volunteer Company's output for its construction.

George Mattison, Slag Industry Pioneer, Dead

One of the pioneers in the crushed-slag industry, George A. Mattison, 78, died at his home in Birmingham, Ala., Feb. 6.

Mr. Mattison was a native of South Carolina but went to Alabama about 1880, engaging in the railroad, telephone and cotton-seed-oil business. About 20 years ago he formed the Woodstock Slag Co. at Anniston, Ala., later moving to Birmingham where he transferred the headquarters of the slag concern.

In addition to operating its slag plants, the company entered the ready-mixed-concrete business several years ago. George A. Mattison, Jr., a son of the deceased, who has been actively in charge of the concern's activities for some time, will head the company.

Columbia Quarry Co. to Operate Fourth Plant

★ The Columbia Quarry Co., operating crushed-stone plants and quarries at Chester, Ill., Krause, Ill., and Valmeyer, Ill., is reported to have closed a deal for the acquisition of another deposit near Prairie du Rocher, Ill., where a plant will be erected and quarry opened.

Consumers Co., Chicago, Announces New Officials

Directors of the recently reorganized Consumers Co. of Chicago, Illinois, have elected George F. Harding, chairman of the board; Martin H. Kennelly, chairman of the executive committee; Joseph Hock, president; John J. O'Laughlin, Charles J. O'Laughlin, and Albert R. Hock, vice-presidents, and George C. Hager, secretary.

Fire Causes Damage at Plant in Connecticut

Fire caused $40,000 damage a few weeks ago when it attacked the plant of the Connecticut High Test Sand & Gravel Co., at Hamden, Conn.

Rebuilding is reported to be under way.

★ The Anderson Sand & Gravel Co., Rockford, Ill., is installing a Kern radial storage system at its plant.

A CORRECTION

In printing the remarks of W. Jess Brown, vice-president of the Dixie Sand & Gravel Corp., Chattanooga, Tenn., at the recent convention of the National Sand & Gravel Assn., at Memphis, PIT AND QUARRY reported him as saying "competition from the T. V. A. . . . is troublesome." Mr. Brown calls attention to the fact that he stated just the reverse—that the T. V. A. plants are *not* regarded as competitors since their production is entirely consumed and not sold.

Lime Shipments Show 27 Per Cent. Increase

PRICES STEADY THROUGHOUT YEAR

Shipments of lime in 1936, according to preliminary figures furnished the Bureau of Mines by producers, comprising about 70 per cent. of the industry, increased approximately 27 per cent. as compared with the previous year, though still 17 per cent. less than the peak year, 1925. The total shipments thus indicated amounted to 3,783,000 short tons valued at $27,464,000. Prices of lime were fairly steady throughout 1936, averaging $7.26 in 1936 against $7.28 in 1935.

The improvement was well distributed among the different consuming outlets. Expressed in percentages, the most marked increase was in shipments of building lime (41 per cent.), following a 55-per cent. improvement in construction during 1936. However, this division has been the slowest in recovering from the depression, and sales of building lime in 1936 (about 923,000 tons valued at $7,992,000) amounted to scarcely 39 per cent. of the maximum recorded in 1925. Substitution of other materials for lime has aggravated the effect of reduced activity in the building industry as a whole.

Shipments of agricultural lime (315,000 tons valued at $2,128,000) increased 11 per cent., a normal improvement. Shipments of dead-burned dolomite for furnace refractories (557,000 tons valued at $4,693,000) advanced 22 per cent. A 25-per cent. increase in shipments of chemical and fluxing lime (1,988,000 tons valued at $12,651,000) is partly attributable to greater steel-making activity.

Lime sold as hydrated lime (1,216,000 short tons valued at $9,700,000) amounted to about 32 per cent. of the total output in 1936, compared with 34 per cent. in 1935. Over one-half the hydrated lime sold was for construction; nearly one-fifth was for agriculture; the remainder was mostly for strictly chemical uses; relatively little hydrated lime is used in the metallurgical industries. An increase of 36 per cent. in sales for constructional purposes accounted for most of the total increase in hydrated lime sales. Sales of this grade of lime for agriculture increased 12 per cent., and those for chemical uses increased only 2 per cent.

As in former years, Ohio was the largest producing state.

★ Considerable new equipment has been installed in the plant of the Quarry Products Co., Menasha, Wis., to increase capacity and improve operating efficiency.

Building Continues Steady Climb Upward

ALL CLASSES GAIN IN JANUARY

A gain of more than 20 per cent. was shown in construction during January as contrasted with the figures for December, 1936, according to data from the F. W. Dodge Corp. The January, 1937, total likewise was some 13 per cent. better than the figure for January, 1936. For the 37 eastern states covering all classes of construction, the total amounted to $242,844,000 in January, 1937 and compares with $199,695,700 for December, 1936 and $214,792,800 for January, 1936. Each major geographic district registered a gain over December totals, except New England, the Central Northwest and the New Orleans district (Louisiana and Mississippi). Gains over January, 1936 were scored in all principal territories except New England, the Chicago district (No. Illinois, Indiana, Iowa, Southeast Wisconsin), the Central Northwest, Kansas City district (Kansas, Western Wisconsin, Oklahoma and Nebraska), the New Orleans territory and Texas.

The January, 1937, construction total for the 37 eastern states as a whole included $78,423,700 for residential building, $95,968,900 for non-residential building and $68,451,400 for public works and public utilities. The residential figure was 20 per cent. greater than the December, 1936, figure and more than doubled the total of $37,439,500 shown for this class of construction during January, 1936. Gains in residential building over a year ago were shown for each major geographic area east of the Rockies without exception—the most pronounced gains occurred in the Metropolitan Area of New York, the Pittsburgh territory (Ohio, Western Pennsylvania, Kentucky and West Virginia), the Middle Atlantic States and Southern Michigan.

Six Oxford, Mich., Firms Effect Consolidation

A change in the set-up of six Oxford, Mich., gravel concerns, making them into one company, has been effected. The new company will be known as Ray Industries, Inc., and is composed of the C. N. Ray Corp.; Ray Sand & Gravel Co.; Ray Fuel Co.; Ray Land Co.; State Concrete Materials Co., and Road Builders, Inc.

The consolidation has been made, according to officials, in order to secure more economical and effective operation. Personnel will remain the same as heretofore and offices and plants at Oxford, New Hudson, Utica and Rochester will continue in the same location.

The new company expects to make numerous improvements and plant enlargements.

Wolverine Places Steel Marl Barges in Service

★ A new steel barge which supports the pug-mill on a marl-lake deposit of the Wolverine Portland Cement Co., at Quincy, Mich., has been built and placed in service by the American Steel Dredge Co. The pug-mill is used to break up the marl excavated from the bed of the lake by a clamshell dredge operating alongside. Other barges haul the marl to shore after the material goes through the pug-mill. The American Steel Dredge Co. is also supplying new steel marl barges to replace existing wooden equipment.

One of the marl barges being towed to shore.

C. C. Jones Enters 39th Year in Cement Industry

All directors of the Wolverine Portland Cement Co. were re-elected for 1937 at the annual stockholders' meeting recently. The directors are W. G. Cowell, F. H. Flandermeyer, E. D. Legg, A. B. Walker, W. F. Murray, C. C. Jones and C. D. McKenzie. Mr. Jones was re-elected president, Mr. Murray vice-president and works manager, J. L. Nelson vice-president and sales manager, W. L. Brown secretary, and Miss Flora E. Root treasurer.

Mr. Jones, who has been associated with the concern for the past 38 years and is now starting his 17th year as president, revealed during the meeting that the company enjoyed a 40-per cent. increase over 1935 in production and shipments last year.

★ A Type 331 Marion gasoline-powered shovel, equipped with a ¾-cu. yd. dipper went into service in February at the plant of the Standard Silica Corp. at Ottawa, Ill.

Pennsylvania Stone Producers Convene

STATE TO MAKE STONE-SAND TEST

The annual meeting of the Pennsylvania Stone Producers' Assn. took place Feb. 4 at the Penn-Harris Hotel, Harrisburg, Pa. The report of General Manager H. H. Wagner indicated that the association has an active membership of 90 producers and that the membership is increasing each month. Those attending were of the opinion that the high spot of recent months was the acceptance of stone-sand as fine aggregate in a test-road section to be built on U. S. Highway 30 this spring. The pavement will be a 4-lane concrete highway.

Officers for 1937 are: W. W. Duff, president; C. C. Hartsook, vice-president; J. R. Chamberlin, treasurer, and H. H. Wagner, general manager. The board of directors includes F. O. Earnshaw, Wm. M. Andrews, Mrs. Verna Stahl, John Curtin, M. L. Jacobs, and John Rice, Jr.

U. S. Gypsum Earnings Increase 62 Per Cent.

A 62-per cent. increase in net income was realized by the United States Gypsum Co. in 1936.

Net for the year was $5,328,113, equal after preferred dividends to $4.01 a share on the outstanding common shares. In 1935 the corresponding earnings on the common were $2.47 a share. Cash dividends during the year amounted to $4,123,889, of which $3,576,335 went to the common-stock holders and $547,554 to the preferred-stock holders.

Expenditures totaling $4,666,545 were made for plant additions and improvements and for the acquisition of new properties.

Report Japanese Cement Used in Hawaiian Forts

Pacific Coast cement interests are aroused over the admission by the U. S. War Department that Japanese cement is being used in constructing fortifications on the Hawaiian Islands. The specific purchase was one involving $13,550 worth of cement. The price was said to be "somewhat below" the prevailing price for the same quantity of American-made product.

★ A $175,000 addition is being erected at the plant and warehouse of the United States Gypsum Co. at Los Angeles, Cal.

Develops Method for Treating Spodumene

INCREASED USE MAY BE RESULT

A little-known, little-used mineral with the unlovely name of spodumene is going to be put to work through a process developed by the U. S. Bureau of Mines, to serve mankind in the air-conditioning of buildings, the making of better pottery, and in the production of lithia water, storage batteries, and special types of extremely tough glass. The largest reserves of spodumene are in South Dakota, North Carolina and Maine. Spodumene has heretofore failed in its service to humanity because of the want of a means of separating it from the less valuable associated minerals; also, there was not a sufficient demand for lithium compounds to permit lower prices.

Technologists at the Nonmetallic Minerals Experiment Station of the Bureau of Mines have now found that the spodumene mineral, if heated in a lime kiln, will be converted to a chalky white mass that can be crumbled between the fingers while all the other minerals present in the ore remain strong. Hence, a gentle mulling, followed by a sifting or the use of a gentle current of air, removes the spodumene from the undesired minerals.

The fine dust resulting from this treatment is about 80- to 90-per cent. pure, and from many localities this product will be of acceptable purity. It is much better adapted to use in making lithium chloride than the original hard, dense spodumene. It is also ready to be used in a glass batch, unless nature happened to put magnetic iron minerals in the ore, in which case a preliminary removal of iron minerals would be needed. The pottery makers have desired to use spodumene, but it has been unacceptable because of the fact that at the temperature of a lime kiln it tended to expand and tear pottery to pieces. The *beta* spodumene formed by the heating and now to be sifted out of the heated ore has already been expanded and does not have this disadvantage. Therefore potters are urged to forget ordinary spodumene and to try *beta* spodumene.

Spodumene is the most plentiful of the lithium-bearing ores. It looks much like feldspar and behaves like it. Lithium and lithium salts, heretofore extracted from less common and more expensive ores, now promise to have several important new uses. Lithium chloride solutions, for instance, should find greatly increased use in the conditioning and drying of air in the fast-growing air-conditioning industry.

The results of this work were announced at the annual meeting of the American Institute of Mining and Metallurgical Engineers in New York on February. Details are given in Report of Investigations 3336, *Beneficiation of Spodumene by Decrepitation,* by Oliver C. Ralston and Foster Fraas, copies of which may be obtained from the U. S. Bureau of Mines, Washington, D. C.

Ohio Calcium Co. Has Improvements Under Way

The Ohio Calcium Co., Lawrence, O., near Ironton, has started an expansion program. Two large kilns will be built, a company village for employees maintained and modern mines opened to supply both coal and limestone for the company's operations, according to Carter N. Abe, president.

The program, Mr. Abe said, will place the Lawrence plant among the largest producers of lime in the country. The company recently acquired control of the former Marting Iron & Steel tract at Lawrence, and also acquired the Lawson-Adkins lakes for a water supply, together with 900 acres of mineral lands in Elizabeth and Decatur townships of Lawrence county. The company controls all told about 1,300 acres of mineral lands. The expansion program will increase plant capacity five-fold.

Lime-Putty Plants for New York and Cincinnati

★ The Richter Concrete Corp., Cincinnati, O., has obtained license rights to operate a lime-putty plant under the Brooks-Taylor patents and the equipment, including three aging tanks, with a total capacity of 7,500 cu. ft. is now being fabricated by the Chicago Bridge & Iron Co. at its Birmingham, Ala., plant.

Another lime-putty plant, the largest yet to be erected, is also being built at Birmingham for the Colonial Sand & Stone Co., New York, N. Y. The Colonial plant will have four large aging tanks each with a capacity of 5,000 cu. ft. of putty storage, or a total capacity of 20,000 cu. ft.

12 Storage Silos Built at Leeds Cement Plant

★ Twelve storage silos 26 ft. in diameter and 80 ft. high have been built at the Leeds, Ala., mill of the Universal Atlas Cement Co. as part of its $2,500,000 improvement program. The silos were erected under contract by the Nicholson Co.

Record Year Reported by Superior Cement

BENEFITS FROM COULEE DAM JOB

Deliveries of cement to Grand Coulee Dam was reflected in 1936 operations of Superior Portland Cement Co., which established a new high annual record output of 1,640,000 bbl. for the year ended Dec. 31, 1936. Production for the year was more than 200 per cent above the 1935 output of about 524,000 bbl., Edwin P. Lucas, president, told stockholders at the company's annual meeting.

Unfilled orders for Grand Coulee cement on hand at Dec. 31, 1936, amounted to about 1,450,000 bbl., Mr. Lucas said.

Net operating profit, after depletion and depreciation, but before provision for federal income taxes and surtaxes, was reported at about $554,000. Dividends paid during the year amounted to $496,584, or $6.60 a share on 75,240 outstanding shares of Class A stock. Dividend payments during the year cleared arrearage on the A stock and placed Class B stock in position to receive payments during 1937 if earnings warrant. The junior issue shares equally with A stock in dividends after payment of $3.30 a share to A and $1.50 a share to B stock.

The company spent $120,000 for plant improvements during 1936, resulting in an increase in capacity of 100,000 bbl. annually. Indicated 1936 production was slightly better than 50 per cent. of capacity.

Supreme Court Upholds Prison-Made-Goods Ban

A unanimous decision handed down by the United States Supreme Court has upheld the Ashurst-Sumners Act, barring the shipment of prison-made goods into states having laws prohibiting the sale or possession of such goods. This decision supports state laws barring the sale of prison-made goods imported from other states. The Ashurst-Sumners Act provides for the labeling of prison-made goods besides prohibiting their shipment into states which have legislated against them.

Quarry in Pennsylvania Installs Diesel Engine

★ A 200-hp. Diesel engine has been installed at the plant of the Holmesburg Quarry, Inc , near Philadelphia, Pa., to drive an air compressor. The engine was supplied by the Chicago Pneumatic Tool Co.

A.S.T.M. Committees Report on Progress

SPECIAL CEMENTS ARE STUDIED

Committee C-1 on *Cement* of the American Society for Testing Materials has reported a large amount of data accumulated in the investigation of 34 high-early-strength cements, tested under nine different conditions as part of an extensive but only partially completed study of various accelerated tests for volume change. The studies began last year and are being actively continued.

Considerable study and discussion has been devoted by the Committee to the subject of definition of Portland cement and, while no change was made in the present definition of ordinary Portland cement, as presented in the Standard Specifications for Portland Cement (C 9 - 30), there was important action with regard to the definition when revising the tentative specification for high-early-strength cement. The revision of this tentative standard and its advancement to standard (C 74 - 36) was an interesting development, since the new standard incorporates a number of decidedly new features. An optional compressive-strength test is provided and the fineness tests are now to be made by the turbidimeter. An important change was the deletion of the definition of Portland cement and the provision that, subsequent to calcination, additions other than water or untreated calcium sulfate, or both, may be made, in amounts not to exceed 1 per cent., provided such materials have been shown not to be harmful by tests prescribed and carried out by Committee C-1. Such tests will be made, under certain conditions, by Committee C-1 through the Cement Reference Laboratory at the National Bureau of standards or other laboratory which the committee may select. This is a decided innovation in the work of the Society and has just recently been approved. Nevertheless, such work has already been started in connection with one addition, the tests in this case being undertaken by the Cement Reference Laboratory.

Work is being continued on coöperative studies of methods of chemical analysis. There were reported two proposed methods for determining phosphorus and manganese in cement.

The Cement Reference Laboratory has continued its work of laboratory inspections, being now engaged in its fifth tour, in which tour there are already involved more laboratories than were visited in any one of the preceding tours.

The committee has before it for study a proposed new specification for natural cement. Study is also being made of possible improvements in the present masonry cement specifications. Specifications are being prepared for study by the committee to cover blended cements and slag cements.

In order to combine two former specifications for sand for use in plaster, a joint conference committee of members of Committees C-7 on *Lime* and C-11 on *Gypsum* was appointed. The work of this group resulted in a new tentative specification (C-35) for sand for use in plaster, replacing two standards covering sand for use in lime plaster, and in gypsum plaster.

Committee C-7 is developing specification requirements for hydraulic lime and prepared fibered-lime plaster, and is investigating test methods for determining the soundness of lime.

Richter Concrete Corp. May Open Fifth Plant

Another ready-mixed concrete plant is being planned by the Richter Concrete Corp., Cincinnati, O., which already has four plants in operation in the Cincinnati area.

When the company entered the ready-mixed business it had 17 mixing trucks in service. Now it has more than 50.

Two Cement Companies Report Higher Incomes

The report of the Lawrence Portland Cement Co. for the year ended Dec. 31, 1936, shows net income of $328,132 after interest, depreciation, depletion, federal and state income taxes, including $20,000 tax on undistributed profits, equal to $4.37 a share on 75,000 shares.

This compares with a net loss of $71,418 in 1935.

The Missouri Portland Cement Co. reports for the fiscal year ended Dec. 31, 1936, a net profit of $469,018 after charges and provision for taxes, equal to $1.66 a share on the 282,406 shares of capital stock. This compares with net of $20,848, or 7 c. a share, in 1935.

Lone Star Redeems All Outstanding Debentures

Redemption of all the outstanding 4-per cent. debentures of the Lone Star Cement Corp., totalling $427,500, was effected in February. The notes were issued in 1935 and were to have been payable in 1945. Payment was made at the call price of 103 and accrued interest.

Germany Extends Ban on New Cement Mills

GOVERNMENT ORDERS PRICE CUT

The prohibition of new establishments in the German cement industry, which expired Oct. 1, 1936, has been extended to the end of 1937, according to the U. S. Bureau of Mines. Manufacturers were urged by the German government to utilize the period of favorable and remunerative operation to rationalize their equipment and plant organization, which is said to have been done in most cases.

A price reduction on Portland cement was decreed by the German Ministry of National Economy, effective Nov. 1, 1936. The reduction, 1 mark per metric ton, means an average cut of 5 per cent.

Before the reduction, German wholesale cement prices ranged from 21.53 marks per ton in Berlin to 39.40 marks in Munich. An official statement pointed out that the German cement industry was able to increase its production 40 per cent. in 1935, and the resulting gains should be made to operate partly to the consumer's advantage. The Ministry had tried to induce the manufacturers' organizations to make a price cut voluntarily, but the figures proposed by the manufacturers were deemed insufficient and the compulsory cut was decreed. The Ministry hoped that the price reduction would be passed entirely to the consumer. Cement prices were reduced twice in 1934 and once early in 1935, so the present cut makes the fourth in less than three years.

Public works consume a substantial part of Germany's cement output because of the heavy volume of road building and military construction. In addition, the new conception of national economy for the common welfare is emphasized as a motive behind the decree. Following the decree's issuance the association of blast-furnace- announced a voluntary price reduction cement manufacturers at Dusseldorf of 0.70 mark per ton.

Texas Plant to Erect Bins, Add Equipment

New storage bins and other equipment are to be added shortly at the Houston, Tex., plant of the Lone Star Cement Corp. With the increased facilities, the plant will probably operate both its 400-ft. kilns. Air-separators were installed recently in the finish-grinding department when the company began the production of special oil-well cement.

Editorial

The Dictatorship of the Senile

IN EVERY type of society—early and modern, savage and civilized, simple and complex—life is regulated, conduct is controlled, opportunities are limited, liberties are restricted, progress is retarded by the edicts of those who are within that period of life designated physiologically as old age. Wherever, in the absence of written laws, questions concerning the rights or obligations of persons arise, answers are sought from the old men of the tribe, clan, or community. In them is supposed to reside the accumulated and consolidated wisdom of the group; to them is entrusted the preservation of group customs, group mores, group religious beliefs. In whatever time or place one may select for study the elders are credited with a knowledge bordering on omniscience, a correctness of judgment bordering on infallibility, an absolutism of authority that partakes of the supernatural. They are the court of last resort; they impose their will upon members of all ranks within their jurisdiction, presumably without favor and certainly without opportunity for recourse; they insist upon the length of their experience as the test of their fitness. They believe in the fallacy of stability; their decrees are the voice of finality.

And of written laws and their administration as much may in the main with equal truth be said. The laws which discipline us, as one critic has expressed it, "have been made by the dead and are administered by the dying." Herbert Spencer displayed at least a partial agreement with this perhaps overly-caustic comment when he wrote: "But the cardinal truth, difficult adequately to appreciate, is that while the forms and laws of each society are the consolidated products of the emotions and ideas of those who lived throughout the past, they are made operative by the subordination of existing ideas and emotions to them. We are familiar with the thought of 'the dead hand' as controlling the doings of the living in the uses made of property; but the effect of 'the dead hand' in ordering life at large through the established political system is immeasurably greater. That which, from hour to hour in every country, governed despotically or otherwise, produces the obedience making political action possible is the accumulated and organized sentiment made sacred by tradition."

What is true in the political phases of social life is equally true of almost all other phases. Wherever it is necessary to exercise discipline of some sort, the necessary authority is either grasped by, or relinquished to, the oldest members of the group. When a tribe selects a chief to replace one deceased, the voting commonly favors one who is either the oldest or among the oldest members, an aged hunter or an aged medicine-man, one who because of his long life is supposed to have learned much, so much, indeed, that in savage groups the voice of younger men is seldom heard in protest against the head's proposals or decisions. In civilized society the situation is not much different; in those forms of activity that touch most closely the private lives of individual members of the group—political organizations and religious organizations—final control resides in men of considerable age. The courts and tribunals of greatest power and particularly those of last resort are probably without an important exception composed of and dominated by men in the physical and mental decline of life. Religious organizations in their higher administrative branches, where policies of dogma, ritual and conduct are determined, are likewise in the hands of men who have passed beyond the period of physical and mental adaptability.

THIS domination of the flexible, the adaptable, the growing and the evolving by those who are the least flexible, the least adaptable, the decaying, and the retrogressing begins at birth and ceases only at death. It affects most of our actions in life, it sets the code of conduct for all classes and it prescribes the penalities for infraction of the rules. It sets or attempts to set the behavior patterns in all walks of life; it establishes the criteria by which conduct is judged and the standards by which performance is measured; and its tendency is always and definitely in the direction of stagnation, inactivity, aversion to change, insistence upon the preservation of the *status quo*. Its advice is always that of caution; its influence is always that of restraint; its authority is always that of antiquity.

Old men are usually cold men; certainly they are seldom bold men. They have forgotten the enthusiasms, the hopes, the aspirations of life; losing, or having lost, the vigor of life, they either lose, or have already lost, the great joy of life. They have no encouragement to offer to forward-looking movements of any kind; their social vision is necessarily limited by their diminishing life expectancy; they point with pride to the "good old days," when everything was right with the world. They are in the great period of "viewing with alarm," when, as Koheleth, the preacher in Ecclesiastes, says, "fears shall be in the way."

Few people are aware of the extent to which our institutions have been, and continue to be, influenced by

the qualities that characterize the period of senescence. Education is shaped largely by the senescent, as is evidenced by the reluctance with which innovations are accepted and the determination with which "dead" languages and other remnants of antiquated pedagogical curricula are retained. The tradition of old-age dependability is so strong in the field of formal education that the appointment of a university president under sixty years of age is deemed worthy of comment and a reason for misgiving.

AS HAS been intimated, theology is an outstanding example of fields that are dominated by a reverence for the old—old forms, old beliefs, old men. Wherever it seems desirable to preserve old rituals safe from the encroachment of new ideas, they are entrusted to the care and interpretation of old men, whose natural fear of change will make them defend the long-established and antiquity-sacrosanct practices and ideas against attacks from all quarters. New religious cults are commonly, like their older varieties, started or controlled by aged men and they are notable for the determination with which they cling to outworn beliefs, among which the flatness of the earth continues to be one of those most pertinaciously insisted upon. The use of the word *aeldor* in Anglo-Saxon to designate a chief, a priest, a parent, and an old man sufficiently indicates the extent to which the right to rule—whether in the tribe, the church or the home—was founded on age. Liberalizing movements, in religion as in politics, are usually begun and actively supported by men who are not yet old, by those who can still see the possibility of betterment, the opportunity for advance.

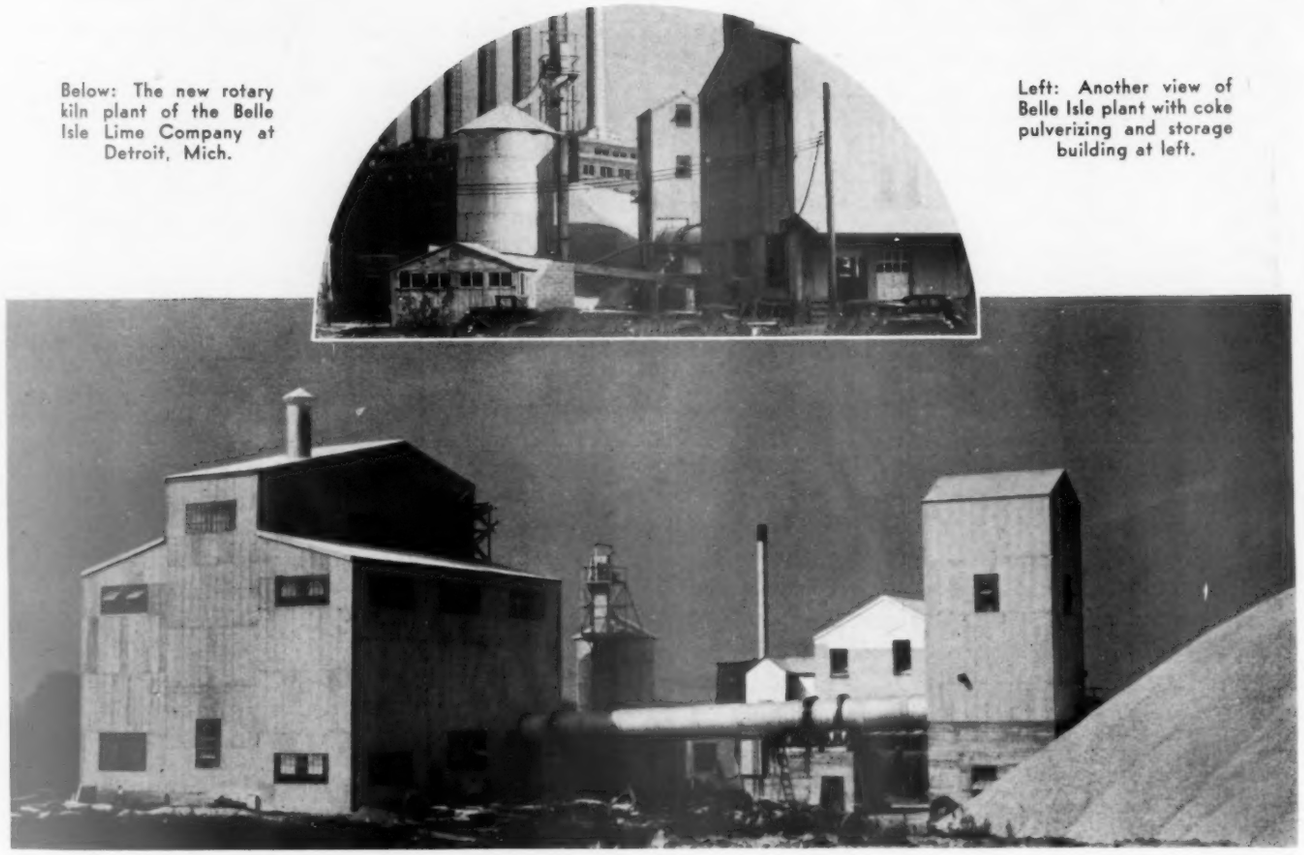
In the field of politics we find the same powerful influence exercised by those in their declining years. Where change is thought to be dangerous, as in the interpretation of laws and in their administration, old heads are considered more trustworthy than young ones. The most ardent defenders of antiquated procedures—courtroom practice, formal documents, statute laws and written constitutions—against even the most trivial threatened change are usually the men of most advanced years, who can no longer understand the necessity for improvement and who associate with the period of their own principal activity the zenith of attainable development.

Strange as it may seem to some—in view of the extent to which business depends on scientific knowledge—commerce and industry offer no exceptions to the supreme position held by senescent men. In departments where progress is essential—in engineering, in production, in advertising and selling—innovations are not viewed with the suspicion common to old age, because these branches of industrial activity are deliberately placed in the hands of men who are still young enough to recognize the necessity for, and the inevitability of, change. In positions where the value of improvement is recognized, pensioning and other retirement plans are usually in effect, so that "new blood," which is the equivalent of saying "younger men," can be brought in to keep the flow of ideas fresh and active. But in the financial branches of a business—the treasurers, the comptrollers, the members of the boards of directors (of whom the chairman is often the oldest)—old age is still accepted (as it should be) as a guaranty of stability and a guard against novelty. Men who are too old to incur the hazards of new activities and new ideas are not likely to make many errors of commission.

"Physiological senility," wrote Clouston, "typically means no reproductive power, greatly lessened affective faculty, diminished power of attention and memory, diminished desire and power to energize mentally and bodily, lower imagination and enthusiasm, lessened adaptability to change, greater slowness of mental action, slower and less vigorous speech as well as ideation." Where creative power is dead, there can be no true appreciation of the yet-to-be-created; where there is little affection, there can be no love for mankind; where attention and memory are impaired and mental power is diminished, there can be no adequate consideration of new proposals; where imagination and enthusiasm are lacking, there can be no longing for better things; when the adaptability to change fails, the desire to let things remain as they are must be uppermost; when ideation declines, it is impossible to think connectedly or to reason profoundly.

OUR attitudes toward political, economic and other social problems are colored too much by the opinions of those who have reached the point in life where serious thinking is beyond their capability; where they crave peace and comfort and freedom from disturbing new-fangled ideas; where (if still active) they want no changes made in the rules lest they be forced to learn and abide by the new ones; where, as they approach the end of their life span, they see no necessity for starting anything new or for altering what seems to them to be complete, well-understood and all-sufficient. Yet it is true, as Tennyson wrote, "Old men must die, or the world would grow mouldy, would only breed the past again." And there, with true poetical insight, he uncovered the best reason for removing the influence of the aged from the field of political, economic and social thinking, for a reliance on precedent, a blind worship of what has been as the sole criterion for deciding upon what shall be, and a dogged impatience with anything that savors of newness are the chief qualities that make the dictatorship of the senile intolerable.

"Tell me what you think, and I'll tell you your age," says an observant friend. As radicalism is the motivating principle in youthful thinking, so liberalism characterizes middle age and reactionism the period of senility. Each one normally passes into its successor, the first change being one of growth, the second, one of decay, and the last, dissolution. Expressed behavioristically, the three stages are marked respectively by the display of courage, confidence and fear. The dictatorship of the senile is the despotism of the fearful.



Below: The new rotary kiln plant of the Belle Isle Lime Company at Detroit, Mich.

Left: Another view of Belle Isle plant with coke pulverizing and storage building at left.

BELLE ISLE'S ROTARY-KILN LIME PLANT

By W. E. TRAUFFER

THE new plant of the Belle Isle Lime Co. in Detroit, Mich., which went into operation October 1, 1936, is the first new commercial rotary-kiln lime plant to be built in the last few years. The plant is at the foot of St. Jean Ave. and has a capacity of about 100 tons daily.

Unlike most other plants, it is located in the heart of its chief market instead of at its scource of raw-material supply. Other features which distinguish this plant from others are the use of petroleum coke for fuel and the application of preheaters for the raw material and the combustion air. A fuel efficiency approaching that of a vertical kiln is obtained.

The high-calcium limestone used in this plant is purchased from the Inland Lime & Stone Co., which operates a plant at Port Inland, Mich. This stone is accurately screened between ⅝-in. and 1¼-in. and is washed before loading. It is transported in self-unloading boats operated by the Morrow Steamship Co. and cargoes of 5,000 to 10,000 tons are unloaded on the plant stock-pile. These boats dock in a slip connecting with the Detroit River. The stock-pile has sufficient capacity to keep the plant in full operation during the winter months.

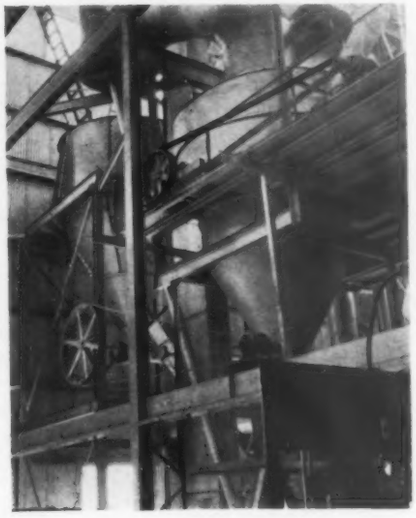
The conveyor tunnel through which the stone is reclaimed from storage is 6 ft. in diameter and 112 ft. long and is built of concrete and steel. Stone is discharged on the 18-in. by 112-ft. tunnel belt-conveyor through seven openings fitted with drop-chute gates which control the rate of flow. A Dings magnetic pulley on the head end of this conveyor removes tramp iron from the stone. A small automatic sump pump keeps the conveyor tunnel and elevator pit dry.

Stone is dropped from the conveyor into a 60-ft. steel-inclosed Jeffrey bucket-elevator, which discharges it into a 10-ton steel hopper from which it falls by gravity into a vertical preheater of the company's own design. In this preheater the stone drops over inclined baffle plates which are perforated to allow the upward passage of hot gases from the kiln. Suction is provided by an American Blower Co. Sirocco fan which is vented to the atmosphere. The efficiency of this preheater is evident from the fact that the kiln gases enter it at a temperature of about 1,400 deg. F. and leave it at a temperature of about 350 deg. F. The stone is taken from the preheater by a Jeffrey-Traylor vibrating feeder to a 25-ft. steel-inclosed Jeffrey bucket-elevator, which discharges it through a feed pipe into the kiln. The stone leaves the preheater at a temperature of about 1,000 deg. F.

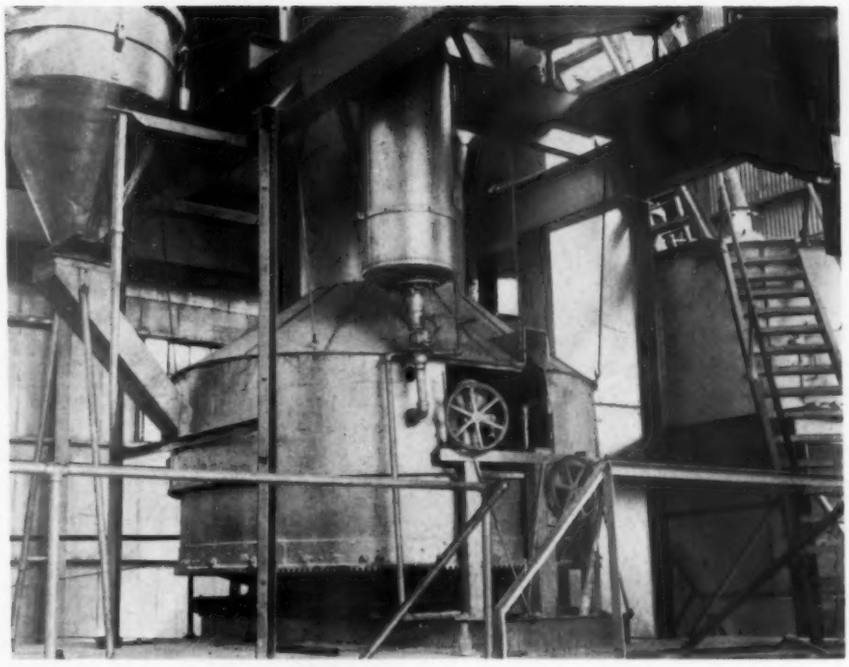
The Vulcan rotary kiln is 6 ft. in diameter and 100 ft. long and has two tires. This kiln is supported on two concrete footings and is in the open except for the feed and discharge ends which are in the stone building and the main plant building respectively. This kiln is lined throughout most of its length with 6-in. General Refractories 70-per cent. alumina brick and is insulated throughout its entire length with Armstrong A 25 insulating brick. The kiln has a pitch of 1 in 20 and is driven by a 15-hp. slip-ring motor through a Ganschow speed-reducer.

From the kiln the lime drops into a Warner soaking chamber which is intended to utilize the sensible heat of the lime to remove any remaining core and to assure a greater uniformity in

quality by providing sufficient time for the temperature to become uniform through every particle of lime. From this chamber, which holds several hours' output of the kiln, the lime drops to a stationary cooler similar in design to the preheater already described. All the combustion air, both primary and secondary, is forced up through the lime in the cooler by a Buffalo fan. A preheating of the combustion air of over 550 deg. F. is obtained and the lime discharged from the cooler can be held in the hand. The soaking and cooling chambers form an integral unit, and complete lining and insulation insure the highest possible degree of heat recovery. A Jeffrey-Traylor vibrating feeder drops the lime into a 72-ft. steel-inclosed bucket-elevator which discharges it into a 175-ton circular steel quicklime storage bin.



Another view of the hydrator with the separator at left.

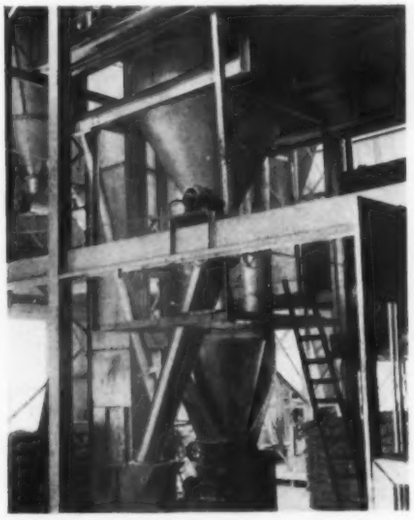


The batch hydrator with weighing batcher at left. At right is elevator feeding hydrated lime to separator.

The petroleum coke used for fuel is purchased from the White Star refining plant at Trenton, Mich. This coke has a fuel value of 16,000 B.t.u., contains less than ½ per cent. ash, and is very low in sulphur. It is received in railway cars from which it is unloaded into a track hopper. A Jeffrey pan-conveyor carries it to a 47-ft. Jeffrey steel-inclosed bucket-elevator which discharges it into a 152-ton steel storage bin in the fuel-pulverizing building.

A Jeffrey vibrating feeder controls the discharge of the coke into a Raymond No. 32 Imp mill, which is of the air-swept type with the blower on the same shaft as the mill. This machine is grinding about 1,200 lb. of coke per hr. to a fineness of 85 per cent. through the 200-mesh sieve and easily supplies sufficient fuel to care for the kiln capacity of 4 tons per hr. Some of the hot combustion air from the cooler is used in this mill to dry the coke and to discharge

The 100-ft. rotary kiln with its feed elevator at left. Part of stone stock-pile is visible.



The automatic throw-out pulverizer which processes rejects from separator.

The vibrating feeder on the pulverizer. In background is pan-conveyor to storage.

the fuel, mixed with hot primary air, into the kiln. About 25 per cent. of the combustion air enters the kiln through the burner and the remainder enters around the burner.

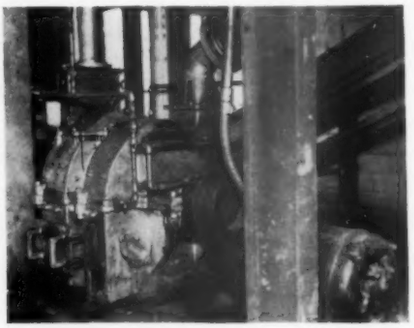
The efficiency of the entire burning system is evident from the high fuel ratio obtained, over 5 to 1, with petroleum coke and the low temperature, about 350 deg. F., of the gases leaving the preheater. Due to the high preheat of both the stone and the air entering the kiln, an unusually high capacity is obtained for a kiln of this size. It has been found necessary to carry a much higher load in the kiln than is normal and to operate it at a much higher speed, 45 sec. per revolution, than is normal for such a kiln.

The entire control of the kiln is in the hands of one operator on the firing floor. Through rheostats he has accurate control over the rates of feed of the three vibrating feeders already described. The first feeder controls the rate of movement of stone through the preheater and into the kiln and the second feeder controls the movement of lime through the cooler. The feeder in the coke mill controls the rate of flow of the coke into the mill and into the kiln.

Tunnel reclaiming conveyor with magnetic head pulley and elevator to preheater.

Discharge of the pebble quicklime from the storage tank is controlled by another Jeffrey-Traylor vibrating feeder which can give any desired rate of feed up to 20 tons per hr. and has rheostat control. Pebble lime is discharged from this feeder on a short inclined reversible belt-conveyor. Running down grade this conveyor discharges the lime on a reversible cross conveyor 78 ft. long which, running in one direction, discharges the lime into box-cars. A belt "kicker" throws the lime to the ends of the car. The car being loaded stands on a Strait track scale so that accurate control of the quantity loaded is possible.

When the reversible conveyor is operated up grade the pebble lime is discharged into a short cross screw-conveyor feeding a Sturtevant No. 0 hammer-mill. The pulverized quicklime is discharged into a 35-ft. Jeffrey steel-inclosed bucket-elevator which drops it into a 15-ton steel storage tank. A Bates 2-tube packer under this tank packs the



The air-swept pulverizer which grinds coke and blows it into kiln.

pulverized quicklime in 50-lb. multiwall paper bags. Lime in bags and pulverized quicklime from the packer bin can also be loaded into cars on the car-loading conveyor described above.

When pebble lime is to be supplied to the hydrating plant the cross belt-conveyor is reversed to drop it into a 65-ft. Jeffrey bucket-elevator, which discharges

Vibrating feeder under quicklime tank with reversible belt-conveyor.

it into a 10-ton steel bin from which it passes into a 1,600-lb. weighing hopper feeding the Clyde batch hydrator. Water used for hydration is measured by volume. The hydrated lime is discharged by a star feeder through a chute into a 48-ft. bucket-elevator. This elevator discharges the lime into a 10-ft. Raymond mechanical air separator. Finished lime is discharged from the separator into a 7-ton steel bin. The separator "rejects" go to a Raymond No. 0 automatic throw-out pulverizer which blows its product into the same bin. Another 2-tube Bates bagger puts the finished hydrated lime into bags. Both chemical hydrate and masons' hydrate are made.

Vibrating feeder which controls rate of discharge of quicklime from cooler.

The control system used in this plant is completely automatic wherever this is possible. The rheostat control of the four vibrating feeders has already been described. Individual motor drives are used on most of the equipment units and the motors are controlled by push-buttons. Jones speed-reducers and V-belts are used on most of these drives. An unusual combination of drives is used on the quicklime pulverizer and its feed screw-conveyor. The pulverizer is direct-driven by a 25-hp. motor and the screw-conveyor is driven through a Jones spur-gear speed-reducer which is driven by a single V-belt from the pulverizer shaft.

Production has not yet reached the plant capacity of 100 tons in 24 hr., but is rapidly approaching it. Another rotary kiln 8 ft. in diameter and 100 ft. long is on the property and it is planned to install this some time in 1937.

The sale of the output of this plant is now about equally divided between the building and chemical industries.

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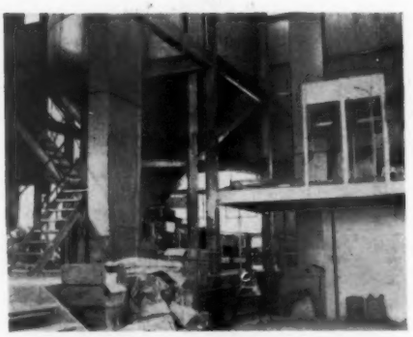

Interior view of plant showing quicklime bin. At right is kiln hood and vertical cooler.

By GEO. D. ROALFE
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Right: The 8-cu.yd. scraper with load of sand arriving at reclamation hopper.

Below: The 12-cu.yd. scraper discharging a load into the plant hopper.

Novel Method of Pit Operation Used by California Producer

IN their search for a more economical and flexible method of gravel recovery from the pit Graham Brothers, Inc., sand-and-gravel producers in the Los Angeles, Cal., market, have adopted Le Tourneau wheeled scrapers. This type of equipment has been quite generally accepted for use in large earth-moving jobs in the West, and it is being used to an increasing extent in commercial sand-and-gravel operations.

This company first used the wheeled scraper at its Whipple Mountain plant, located in eastern San Bernardino County, Cal., close to the Colorado River. This plant was installed to furnish concrete aggregates under a contract with the Walsh Construction Co., general contractor in the construction of the Whipple Mountain Tunnel for the Metropolitan Water District of Southern California. This tunnel, approximately 6 mi. in length, called for the production of 180,000 tons of concrete aggregates. The material was located about 1 mi. from the adit of the tunnel in a typical desert wash. Test pits dug by the district showed depths of from 8 to 20 ft. of workable materials. The original installation at this plant included a double-drum motor-driven hoist equipped with a 2-cu.yd. drag bucket. This equipment was used to recover the first 25,000 tons and would have proved effective for a considerably larger tonnage except that the deposit below the 8-ft. level was shot through with thin streaks of *caliche*, lime, etc. This *caliche* adhered to the coarse aggregate with such tenacity that the washing possible with the limited water available proved fruitless. This caused the rejection of all materials below the 8-ft. level.

A small tonnage of material was loaded by the use of a gasoline- powered crane, equipped with 1-½-cu.yd. bucket, into dump trucks and hauled to the plant. This method also had to be discontinued.

Nearly 150,000 tons of finished aggregate was produced by the plant from materials dug and transported by a 12-cu-yd. Le Tourneau wheeled scraper pulled by a Caterpillar Diesel tractor. Due to the sweeping nature of the operations, this equipment proved to be extremely flexible, which aided greatly in balancing the production between fine and coarse aggregates.

The Metropolitan Water District's specifications called for a jump mix, containing less of the pea gravel sizes (⅛-in. to ⅜-in.) than is the usual practice. This, coupled with the relative predominance of these sizes in the natural deposit, necessitated the scalping out of from 25 per cent. to 30 per cent. of the pit material as waste. This waste was removed from the scalping screen by a belt-conveyor and deposited in a ground waste-pile. As the plant produced an average of 2,500 tons of finished aggregate per day, the scrapers not only had to deliver between 3,300 and 3,500 tons of pit material at the trap but also had to remove between 600 and 800 tons from the waste-pile each day.

The experience gained from this operation led Paul C. Graham, president of Graham Bros., Inc., to consider the use of scraper units at one of the company's commercial plants. The El Monte plant selected for this trial is located in the bed of one of the tributaries of the San Gabriel River about 10 mi. east of the City of Los Angeles. As in most of the deposits in this section of California, there is a deep filling of sand and gravel which in this particular area has been worked to depths of 150 ft. and more. The material is principally granitic and is the result of the erosion of the granites of the adjacent coast-

Tractor and 8-cu.yd. scraper transferring material from bins to stock-piles.

range mountains. The plant is located on the west bank of the river which is dry except during a part of the rainy season. In the early operations at this deposit the material was dug close to the plant. Excavation was accomplished by use of the typical drag bucket operated by a double-drum hoist. Typical diggings of this character form roughly-circular pits with relatively-steep sides. In moving from one location to another considerable unworked material is left between adjacent pits. The practice is to attempt to direct flood waters when they do occur into an abandoned pit and in this manner protect the pit then in operation from silting up. If the entire bed of the stream

The 12-cu.yd. wheel scraper picking up a load in pit. In background is the plant and part of the 600-ft. suspension-bridge conveyor formerly used.

were excavated uniformly, the hazard from floods and silt would be greatly reduced.

At the El Monte plant the near areas are almost exhausted with the exception of the material which is left between abandoned pits and which still has considerable economic value because of its proximity to the plant. About three years ago the impracticability of working these margin areas with a drag bucket and hoist became apparent and the company constructed a 600-ft. suspension bridge spanning the river bed and worked area. Excavation was handled by bucket and hoist, the material being delivered to a receiving hopper equipped with a reciprocating feeder discharging on a belt-conveyor. This conveyor fed an 800-ft. belt-conveyor, running on and over the suspension bridge and delivering materials to the scalping screen at the plant.

Since the adoption of the Le Tourneau scraper at this plant this field-conveyor system has been abandoned. Now all the material is dug, loaded and hauled to the new receiving hopper by means of a 12-cu.yd. Le Tourneau wheeled scraper pulled by an R. D. 8 Diesel Caterpillar tractor. The equipment in the field includes a Le Tourneau "bulldozer" which is attached directly to the tractor. This has been used mostly in the preparation of the driveways to the new receiving hopper. As the depth of the pit increases hard strata, which will require the "bulldozer" for digging, may be encountered. Operations show that the scraper is capable of delivering 150 tons of material per hr. to the receiving hopper with an average haul at the present time of approximately 1,200 ft. By working on a long-haul and short-haul basis the trap can be kept filled and the deposit worked to a considerably greater area.

In this operation the materials in the wash are unusually free of silt but there is some excess of sand over the market requirements. The material from the receiving hopper is transported by a belt-conveyor to a 5-ft. by 8-ft. scalping screen, which splits the rock sizes for the two stages of crushing and the by-passing of uncrushed gravel around the crushers.

The crushing units consist of a 5 K Allis-Chalmers Gates gyratory primary crusher and a 3-ft. Symons cone secondary crusher. All the sizing of crushed rock and gravel is done separately and by means of screens mounted above the storage bins. The material is raised and fed to these sizing screens by two bucket-elevators. The gravel elevator discharges the uncrushed gravel and sand on a 42-in. by 15-ft. triple-jacketed revolving screen. The several gravel products of the screen fall by gravity into bins below, and the sand which has been washed through the external jacket of the screen by means of water sprays is deposited in a drag sand-washer. The washed sand is conveyed from the washer to the stock-pile by a cantilever belt-conveyor.

The other elevator discharges the crushed rock into a 42-in. by 15-ft. triple-jacketed revolving screen. The several products of this screen fall by gravity into bins below. This plant includes a recrushing circuit composed of

(Continued on page 61)

The 8-cu.yd. scraper picking up a load of sand from stock-pile which is to be hauled to reclamation hopper.

Mining Engineers Discuss Production and Processing Problems at New York

THE program presented by the Industrial Minerals Division of the American Institute of Mining and Metallurgical Engineers at the annual meeting in New York, February 15 to 18, included sessions on mining and milling methods, geology, and other phases of nonmetals production. In addition the Health and Safety Committee of the Institute sponsored a symposium on silicosis which is of vital importance to nonmetals producers.

Mining Methods.—Harry A. Roe [1] discussed the function of the power scraper and the slack-line cableway excavator in mining nonmetals. He limited his presentation to excavating equipment which combines digging with transportation to a "remote" dumping point. Such equipment includes the drag scraper, gravity return scraper, and slack-line cableway excavator. These types of machines differ, but are complementary; their relationship is similar to that among various kinds of power shovels.

The drag scraper is commonly used for underground slushing or loading, and for bank excavations where the discharge is at the bottom of the bank. Radial excavations are customary, but a tower installation allows operations in a rectangular pattern. The maximum distance for which a drag scraper can be used economically is 500 to 600 ft.

The gravity-return scraper is commonly used in sand and gravel and other loose materials where the discharge point is as distant as 700 to 800 ft. from the deposit. In theory the gravity-return machine is slightly more efficient than the drag scraper; in actual operating practice, however, the difference in power consumption apparently is not appreciable. This type of machine is particularly advantageous in underwater work.

The slack-line cableway excavator can be used in deep pits and has the further advantage of direct delivery to bins or cars.

All three machines give best results only with free-flowing materials. Difficulties are encountered in handling noncaving deposits, and the capacity in broken rock may be only half that in loose sand and gravel. The capacity of

Seated at table, left to right—S. H. Dolbear; C. A. Fulton, newly-elected president; Oliver Cowles, retiring president; and J. R. Thoenen, secretary.

any of these machines also depends upon the size of the bucket, the speed of operation, the density of the material, and the length of the haul. Each is essentially a one-man machine which means low labor costs. Maximum economy in using this type of excavating equipment depends upon engineering ingenuity to develop the proper type of installation.

In the absence of S. A. Trengove, Gerald Sherman presented an abstract of his paper on open-pit mining by trucks and conveyor belts. Operators of the open-pit iron-ore mines on the Mesabi range have been experimenting with the use of trucks and conveyor belts rather than track haulage. A similar installation for conveying aggregates used in the Grand Coulee Dam has been described (P. & Q., Jan. 1936, pp. 48-65, 79).

One of the advantages of conveyor belts is the steeper grade. In a typical installation on the Mesabi range, for example, track haulage on a 3-per cent. grade required 1,668 ft. of track from the bottom of the pit to the surface, but at the same pit only 166 ft. of conveyor on a 32-per cent. grade was necessary. Among other advantages favoring conveyors are the relatively-low cost of new equipment, lower operating costs, the elimination of track problems, and the simplification of clean-up operations. One of the problems arising in using conveyors is the disposition of bowlders too large for the belt to handle. Common practice now is to slide them off the grizzly to be broken further before handling. If conveyors come into wider use in pit transportation more elaborate loading installations probably will be set up and portable crushing units may be necessary to follow the shovels in maintaining a uniform size of material for the belts to handle. Freezing, as well as muddy material, may cause some trouble in conveyor haulage.

Ball-Mill Grinding.—W. H. Coghill and F. D. DeVaney of the Mississippi Valley Experiment Station of the Bureau of Mines presented a summary of results of experiments in ball-mill grinding. The complete report of this investigation to be published later will cover ball-mill grinding comprehensively, but it is possible here to call attention to only a few of the findings.

With the proper speed in batch grinding a thick pulp was found desirable for capacity, but a thin pulp was better for efficiency. The wet-rod milling showed the best efficiency and capacity with only 25 lb. of material in the mill; 39 lb. was required to fill the interstices.

Rods did more grinding than an equal volume of balls, but more power was required.

Rods of extremely-small diameter gave more selective grinding than large balls. The rods, being 35 in. long, were heavier than the balls. Undoubtedly weight was a more imoprtant factor than the diameter of the medium in the grinding of coarse particles.

In comparing wet and dry grinding the tests were paired so that all the set variables were the same except pulp consistency (wet or dry). With an intermediate weight of material charge selective grinding was of the same degree; with a heavy-material charge wet grinding was more selective; and with the light-material charge dry grinding was more selective. Wet open-circuit ball-milling gave 39 per cent. more capacity and 26 per cent. more efficiency than dry.

Very hard balls were better than ordinary balls, particularly when the material was very hard. The efficiency of battered reject balls was about 11 per cent. less than of new spherical balls.

Mr. Coghill also presented an abstract of a paper by F. Cadena of the Tennessee Valley Authority describing the crushing and grinding of 1,000,000 cu. yd. of aggregates used in Norris Dam. Hammer-mills were used for fine crushing because they produced properly-shaped aggregates with the minimum of "slivers" or flaky particles. The discussion tried to bring out the difference between crushing and grinding. One idea advanced was that crushing produced sieve sizes of material, whereas grinding gave micron sizes. Another suggestion was that "crushing" should apply to a closely-graded product with the minimum of fines, and "grinding" to everything passing a certain mesh irrespective of grading.

Pulverizing Efficiency.—Raymond Wilson,[2] formerly of the Portland Cement Assn., described a method for estimating the efficiency of pulverizers specifically as applied to cement manufacture. The development of methods of analyzing mill performance has been hampered by the lack of a suitable method for measuring the work actually done in pulverizing. There has been no acceptable standard with which mill performance might be compared. As a consequence, it was not known whether the margin of possible movement in pulverizing operations was large or small. Even direct comparison of different types of mills was seldom possible because most plants had only one type of mill for each type of service. Comparisons between plants were difficult because of differences in the grinding characteristics of various clinkers.

The grindability test developed by Mr. Wilson is a combination of the pulverizing method of Gross and Zimmerley and the surface-measurement method of Wagner. The pulverizing apparatus and method have required some modification to fit them to the specific needs of a clinker-grindability test. The test gives the grindability of the clinker directly in terms of the surface produced by a unit of energy applied under conditions about as favorable as can be imagined.

The crushing apparatus for the impact-grindability test consists of an anvil, a plunger, and a guide tube. Impact is supplied to the plunger by a polished-steel ball of the sort used in ball-bearings. The ball release is an electromagnet provided with a steel ring which centers the ball at the same place for successive drops. The magnet is supported in a frame that can be set to allow the ball to drop various distances and is placed so that the ball strikes the center of the plunger when the anvil is set with its sides flush with the sides of the column.

In the test procedure that has been adopted as the standard a 1-gram portion of 20- to 28-mesh crushed clinker is subjected to the impact delivered by a 24-in. fall of the ball. The clinker is spread uniformly over the surface of the anvil with the brass guide in position to serve as a retaining ring. This quantity of clinker makes a layer one particle thick, covering more than half the crushing surface of the anvil. The plunger is inserted in the guide and rotated slightly without pressure. The anvil is placed on the column, the ball is placed in the magnet, and released by switching off the current. The crushed material is washed into a test tube with kerosene from the Turbidimeter stock. The crushing operation is repeated until four portions have been treated. Some clinkers yield too much or too little fine material from four blows for the best results in the Turbidimeter. If this situation arises, the duplicate test is made with three or five blows, or in rare cases with six blows. The entire accumulated product is tested in a Wagner Turbidimeter (P & Q Handbook, 1937 ed., p. 193) in the manner prescribed for tests of cement in that apparatus.

Test data indicate that there is room for substantial improvement in the design and operation of clinker-grinding equipment. The efficiency of various mills ranged from 13 to 43 per cent. By setting a probable theoretical limit of performance the grindability test is helpful in estimating the distribution of power losses and in analyzing the possibilities for improvement.

J. Bruce Clemmer described a short-column hydraulic elutriator for measuring subsieve sizes developed by S. R. B. Cooke[3] of the Rolla experiment station of the Bureau of Mines. This device will fractionate up to 200 grams of material into 10 or 12 sizes between 270-mesh and 2.3 microns for silicate minerals and 1.2 microns for sulphide minerals. A complete test can be made much faster than with the long-column elutriator formerly used but of course not as fast as surface-area determinations with the Wagner Turbidimeter.

Technical Progress.—Oliver Bowles,[4] of the Bureau of Mines and chairman of the Industrial Minerals Division, reviewed technical progress in nonmetals mining and beneficiation during 1936. He particularly stressed the developments in home-insulating materials. Glass wool has come into actual competition with rock and slag wool, and the varying properties of mineral wools now on the market indicate a need for standard specifications covering weight, percentage of "shot," and possibly other qualities. The use of vermiculite is also growing.

Dr. Bowles called attention to the increasing importance of the so-called "stabilized" farm-to-market roads built with local gravel and treated with calcium chloride, salt, or (more recently) a cement-hardened clay surface. German investigators have found that the addition of 4 per cent. bitumen to Portland cement tends to eliminate internal stresses and reduce cracking.

Concrete-surfaced lumber can be used with a steel frame in constructing a typical frame house that is fireproof. Concrete made with sawdust and sand is again attracting attention abroad. In Spain a process for making iron and cement simultaneously in a rotary kiln has been developed.

Lime is used in Europe for making a new heat- and sound-insulating building material known as "Microporite." Silica dust, ground to a fineness of 98 per cent. through a 200-mesh screen, is mixed with lime and water, molded, and treated with steam for 7 hr. The reaction is similar to that which takes place in the manufacture of sand-lime brick but is more rapid and complete. The units are strong and weigh only 25 to 50 lb. per cu. ft. They are for interior use only.

A German patent covers the manufacture of artificial pumice. Asbestos fabrics now made in England with new non-fading dyes may have numerous household uses such as fireproof aprons, rugs, or table covers. Bentonite is being used in pressure grouting to prevent water seepage.

Nepheline syenite continues to replace feldspar in glass and pottery. Florida phosphate-rock producers are experimenting with high-temperature calcination to make a large part of the tricalcium phosphate available as plant food. Circular saws with carborundum teeth are used for vertical and horizontal cuts in quarrying talc furnace blocks in Washington. Dr. Bowles also discussed new trends in ceramic and refractory materials.

G. C. Branner, state geologist of Arkansas, reported that the black marble deposits of his state are being developed as a source of black marble in direct competition with Belgian black. The waste is used for terrazzo chips.

Spodumene.—Foster Fraas[5] and O. C. Ralston of the New Brunswick experiment station of the Bureau of Mines described a method for beneficiating spodumene by decrepitation. The procedure consists of forming pulverulent beta spodumene by heating, selectively grinding the beta spodumene leaving the quartz and feldspar unchanged, and concentrating the spodumene by a particle-size separation. Grinding is most effectively accomplished by impacting the particles against a stationary plate.

With ores carrying 3 or more per cent. lithia it has been possible to obtain better than a 90-per cent. extraction with a concentrate containing over 6 per cent. Li_2O out of a possible 7 per cent. in the available mineral. Recoveries are poorer on the lower-grade ores. One of the ores treated consisted of very fine quartz and spodumene crystals but, nevertheless, was separable by this method. Ores from a variety of sources in both South Dakota and North Carolina have been tested. The tin contents of these ores remain in the separated gangue and are rejected from the beta spodumene concentrate.

Slag in the Birmingham district.—James R. Cudworth[6] and Joseph C. Mead described the utilization of slag in the Birmingham district. There are at the present time two companies, the Cheney Lime & Cement Co. and the Southern Cement Co., manufacturing puzzuolan cement; three companies, the Birmingham Slag Co., the Woodstock Slag Co., and the Swann Chemical Co., making slag aggregates and by-products; one company, the Tennessee Coal, Iron & Railway Co., a subsidiary of the U. S. Steel Corp., producing ground open-hearth basic slag for soil conditioning. Two companies, the Sloss Sheffield Steel & Iron Co. and the Woodstock Slag Co., make slag concrete in ready-mixed plants and one company, the Superock Co., manufactures fine and coarse slag aggregates under a new granulation process. No Portland cement is made with slag as an ingredient, because dolomite is used so extensively as a blast-furnace flux that the magnesium content of the slag is excessive.

The various companies utilizing slag other than those who also produce it obtain their supplies by contract. Sometimes the slag company contracts for the entire output of a furnace and removes it from the cooling pits with its own power shovels. For the manufacture of slag cement the water-granulated slag is obtained by contract and delivered to the cement plant by railroad cars. Some of the iron-and-steel companies, either directly or through subsidiary companies, utilize the whole or part of their slag production.

The principal uses of slag call for its preparation at the furnace either as granulated or air-cooled slag. In the former case the slag as it flows from the cinder notch in the furnace falls into a trough, passing through a water spray which granulates the slag. This trough must be deep enough to prevent the slag from solidifying on the bottom and the water swift enough to sluice it along. The success of the granulation is said to depend upon the rapidity with which the quenching takes place after the slag leaves the furnace. The granulation process breaks the slag into small pieces and increases the porosity. There are also two chemical properties produced by this sudden chilling: (1) if the slag is of the proper composition, it becomes hydraulic and (2) the slag is partly desulphurized. The manufacture of slag cement requires careful control of the granulation steps.

A more recent development in granulation for the production of light-weight aggregate was introduced into this country from Germany and is used in the Birmingham district at the blast-furnaces of the Republic Steel Co. for the manufacture of Superock. The hot slag is brought from the furnaces by cars and discharged into a patented machine, which contains paddles 5 ft. in diameter driven at 900 r.p.m. Water under 80 lb. pressure is introduced into the machine by a pump. The resultant explosion of gases in the hot slag produces a very porous or cellular structure in the hardening slag. The paddles break up the lumps, which are later recrushed and sized.

In addition to the use of slag for concrete aggregate and in slag cement, the finer sizes of crushed and screened air-cooled slags are used in rolled roofing and tar roofing. Quantities of air-cooled slag are used for railroad ballast. Slag bricks and slag blocks are manufactured in the Birmingham district from fine slag aggregate, both of the solid and hollow type. These have high fire-resisting qualities, good insulating and sound-resisting properties and excellent workability in cutting and nailing. The light weight of the concrete products made from fine slag aggregate is an important advantage.

The production of basic open-hearth slag as a soil conditioner amounts to about 35,000 tons per year. Experiments have been made on the utilization of slag for glass manufacture. This use has been successful in the laboratory but has not been developed beyond that point. In other districts blast-furnace slag has been used for the production of slag wool for both sound and heat insulation, and as a filter medium for acids and gases. A more recent use has been the utilization of slag dust as a base on unimproved city streets for future oil mix or asphalt surfacing.

The normal production of blast-furnace slag in Alabama would be approximately 2,000,000 tons annually but there are many old slag dumps and some of them are being utilized. The normal production of slag other than blast-furnace is not available. The amount of slag marketed is approximately equal to the annual production.

Industrial Uses of Limestone and Lime.—M. F. Goudge[7] of the Department of Mines, Ottawa, Canada, presented an interesting paper on the industrial uses of limestone and lime. In addition to the well-known uses as construction materials and in the agricultural, chemical, metallurgical, ceramic, paper, rubber, paint, and petroleum industries, Mr. Goudge stressed the importance of limestone in times of war.

Limestone and lime have important *rôles* in the production of iron and steel, copper, nickel, lead, zinc, and other metals and also in the manufacture of rubber and grease, all of which are indispensable in modern warfare. The fixed-nitrogen industry, which in times of war can be speedily diverted to the manufacture of powerful explosives and propellants, is largely dependent on supplies of high-calcium limestone. This industry is now established in most major countries to aid in attaining national self-sufficiency as regards war materials. During the World War synthetic phenol, a chemical for which in peacetime there is little use, was manufactured on a large scale by a process requiring the use of lime. The manufacture of soda lime is important, as it is an effective agent for absorbing toxic gases. Both oxygen and hydrogen for war use may be prepared with the aid of lime. Chlorine may be made by the oxidation of hydrochloric acid by manganese dioxide, in which process lime is used. Processes such as these are of great value during war-time when large supplies of chemicals are wanted suddenly and when existing plants can not be expanded sufficiently fast. Alloys of magnesium are coming rapidly to the fore as structural materials where lightness and strength are essential, particularly for aircraft manufacture, and in a few years magnesium alloys will probably be widely used in industry in general. At present, so far as this continent is concerned, metallic magnesium is derived mostly, if not entirely, from salt brines, but processes have been perfected, and are already in use in Europe, for its extraction from dolomite, which is the most common source of magnesium. Undoubtedly dolomite will be used more generally in the future, especially if a large demand for magnesium should suddenly arise as in the event of war.

Mr. Goudge emphasized the need for a complete treatise on limestone and lime as well as the need for further research and an educational campaign to overcome unfounded prejudices.

Flotation of gypsum.—W. E. Keck[8] and Paul Jasberg of the Michigan College of Mines and Technology sum-

marized the results obtained in the flotation of gypsum. The flotative properties of gypsum were studied primarily because it is a source of sulphur impurity in the high-sulphur iron ores of Michigan. Gypsum was not floatable with xanthates but excellent flotation was obtained with sodium oleate and palmitate. The practical application of flotation in the gypsum industry is probably for future consideration, but if used to purify iron ores large quantities of gypsum may become available as a by-product of the process.

G. R. Mansfield outlined methods of prospecting phosphate-rock lands in Florida during which test holes as deep as 109 ft. were drilled with a hand auger. Other papers of less general interest to nonmetals producers are listed in the bibliography.[9]

Silicosis.—Dan Harrington, who is in charge of the Bureau of Mines' work on health and safety in mining, was the first speaker on the silicosis program arranged by the Health and Safety Committee of the Institute. He summarized the hazards resulting from exposure to dust and recommended practices to eliminate dust in mining. The dust-disease problem, according to Mr. Harrington, is strongly controversial and burdened by misconceptions. He commented on the phenomenal success of rock dusting in coal mining as a preventive for explosions, which even at their worst did not take as many lives annually as silicosis. It is difficult, however, to convince mine operators of the importance of dust elimination for the results are not immediately apparent as in the case of rock dusting.

The best-known and probably most serious of all dust diseases is silicosis, but Mr. Harrington cautioned his listeners against losing sight of the fact that asbestos, talc, anthracite, and other mineral dusts cause similar lung ailments. He was strong in his contention that all dusts are harmful and that the only remedy is to eliminate dust at the source. In addition to the lungs, dust may cause trouble in respiratory passages, stomach, liver, kidneys, eyes, ears, and other internal or external parts of the body. It frequently causes serious skin eruptions.

The quantity of dust to which an individual has been exposed is the primary factor in contracting silicosis, but it is virtually impossible to measure this quantitatively. The dust count may fluctuate widely with changes in temperature and humidity and even in different locations in the same room or stope. In Mr. Harrington's opinion, the establishment of a dust count as a final preventive for silicosis would be worthless. Knowledge of harmful sizes of dust should be extended. The examination of persons with silicosis indicates that particles ranging from .2 to 10 microns are commonly found in the lungs, but the larger sizes may be equally harmful in destroying the filtering action of the respiratory passages and allowing the smaller particles to pass freely into the lungs.

The only effective preventive for silicosis is the control and elimination of dust at the source. This can be accomplished by the installation of proper ventilating and dust-collecting systems, through the use of water to kill the dust at the source, and the postponement of blasting until after the working shift has left the mine. Wet drilling will aid materially in reducing dust hazards, but operators hesitate to incur the expense of piping water to the working face and even the men who receive the benefits frequently complain about sloppy working conditions. Water should also be used in the mine to kill dust at the grizzlies or other dusty places. Water, of course, can not be used in coal mines that are rock-dusted except at the face, but combined with proper ventilation such mines can be made safe from the danger of dust diseases. It is difficult to remove dust in metal or nonmetal mines with big stopes or rooms, but the liberal use of water will reduce the dust hazard. Blasting not only stirs up dust but results in fumes that may have a harmful effect. It is wise, therefore, to prohibit blasting during the working shift, except possibly at the end of the shift if blasting on the off-shift is not feasible.

In closing his remarks Mr. Harrington repeated his assertion that all dust is a menace and should be killed at its source. He also recommended continuing present research to expand the existing knowledge of dust diseases and their causes.

Dr. A. J. Lanza summarized the results of 37,000 examinations at the Picher clinic and agreed with Mr. Harrington that the severity of the exposure rather than the susceptibility of the individual is the principal factor in contracting silicosis. He admitted that lungs weakened by tuberculosis or other respiratory disease would undoubtedly be affected by lesser quantities of dust. It was found at Picher that silicosis was more prevalent among Negroes than whites, but possibly this may have been due to more tuberculosis among the Negroes. Dr. Lanza cautioned against making any positive statements regarding silicosis, and particularly against legislation based on dust counts. He admitted the usefulness of dust counts, however, provided they are taken intensively and really represent a fair average of actual working conditions. In general, air containing more than 5,000,000 particles of high-silica dust per cubic foot should be avoided wherever possible. Basing compensation suits on diagnosis rather than disability has not been entirely fair to the operator, and in part is responsible for the deluge of damage suits that have upset the whole scheme of compensation insurance.

Of outstanding significance was the admission by both Mr. Harrington and Dr. Lanza that even now virtually nothing is known about silicosis, although it is one of the most serious problems confronting the industry.

Fulton Elected Chairman.—Chester A. Fulton, president of the Southern Phosphate Corp., was elected chairman of the Industrial Minerals Division for the coming year, succeeding Oliver Bowles. J. R. Thoenen of the Bureau of Mines continues as secretary. No announcement has yet been made regarding the fall regional meeting of the division.

Bibliography.—Unless otherwise indicated, copies of the following papers referred to in the discussion are available from the secretary, A.I.M.E., 29 West 39th St., New York, N. Y. They are free to members of the Institute; a small charge may be made to nonmembers.

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The new batching plant and truck-mixers. In the foreground are some of the company officials.

Oil Boom in Texas Town Spurs Demand for Pre-Mixed Concrete

THE city of Corpus Christi, Tex., which in 1934 was a quiet coast resort town with a population of 30,700, has since that time developed into an "oil-boom" town with rich producing fields encroaching on its borders. The city's housing facilities have proved to be inadequate to take care of the constantly-growing additions to its population and a building "boom" has resulted. Many families are living in tents and tourist camps until permanent residences can be provided for them. Even the many large hotels in this resort town now seldom have a vacancy.

This building "boom" was responsible for the erection of a ready-mixed-concrete plant by the South Texas Brokerage Co. to supply the demand. This plant, which is of all-steel construction, went into operation late in November, 1936, and has a capacity of about 175 cu. yd. of batched materials daily. The company has been selling building and ceramic tile for the past ten years and is also distributor in Corpus Christi and vicinity for cement and for sand and gravel produced by the Fordyce Gravel Co. of Pharr, Tex.

Sand and gravel are discharged from railway cars or trucks into the two compartments of a ground storage bin. Gates in a concrete conveyor tunnel let the aggregates fall on an 82-ft. inclined belt-conveyor which discharges them through a swinging spout into a 22-cu.yd., 2-compartment steel bin at the top of the batching plant. Goodyear belting and Alemite fittings are used on this conveyor which is driven by a 5-hp. motor. The sand and gravel are weighed in a 5,000-lb. Blaw-Knox 2-compartment weighing-batcher equipped with a 2-beam scale. The contents of the batcher are discharged through an arc gate into the mixer trucks. Cement of any desired brand is dumped from sacks into the batcher through special openings in one side as the batch is discharged. Mixing water is supplied to measuring tanks on the trucks from two 50-gal. steel tanks on the batching floor which are connected to the city water mains. Special quick-acting valves are used on these tanks to speed up the transfer of water.

Two new Chain Belt Rex 1½-cu.yd. Moto-Mixers mounted on 1937 Chevrolet truck chassis are used to mix and deliver the concrete. These mixers are of the latest improved type with independent Waukesha gasoline-engine drives. Goodrich Silvertown tires are used. Additional truck-mixers are to be added as needed. The company also owns 7 Chevrolet trucks and an International truck which are used to haul sand and gravel to the plant and to deliver sand, gravel, cement, tile, etc. Most of the concrete sold is going into

(Continued on page 61)

The two 1½-cu.yd. truck-mixers as they were being delivered to the plant.

The sand-and-gravel storage piles with conveyor being installed in concrete tunnel.

By W. E. TRAUFFER

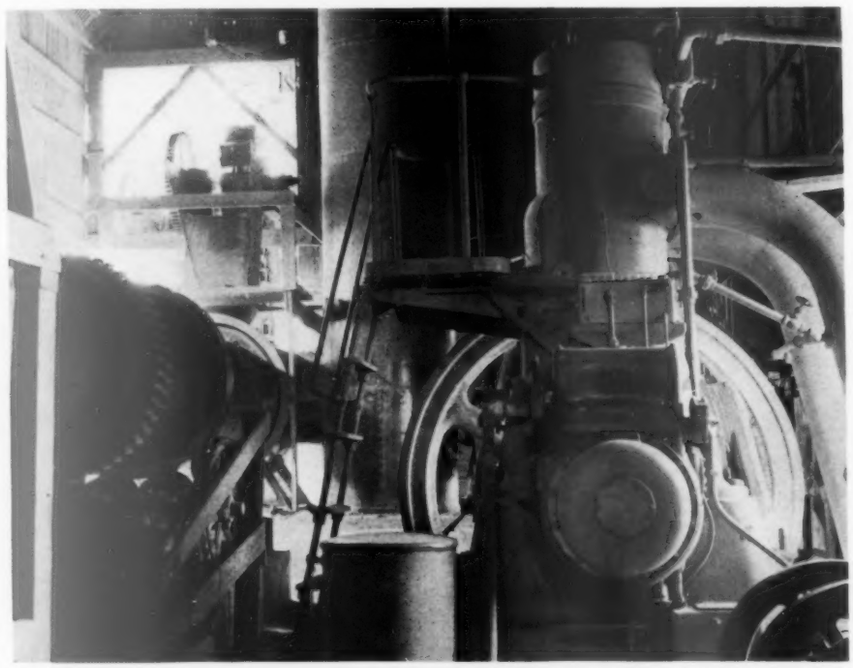
The ¾-cu.yd. gasoline drag-line used for loading car on plant incline.

New Dolomite Plant in Florida Employs Diesel-Electric Power

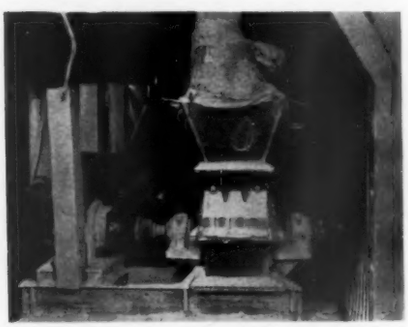
THE discovery in recent years of deposits of "dolomite" in central Florida has started a new industry which is steadily growing in importance. The most recent development in this industry is the plant of the Florida Dolomite Co., at Dolomite, Fla., 3 mi. north of Sarasota, which went into operation April 1, 1936. This deposit was found about a year earlier after a 10-yr. search by officials of the company. The deposit of 160 acres was thoroughly prospected before the plant was built.

This "dolomite" differs in characteristics from the dolomite with which people are familiar in the northern states. It is a comparatively soft, marl-like material containing about 50 per cent. calcium carbonate and 38 per cent. magnesium carbonate. There are also small amounts of silica, iron, alumina and organic matter. This material is pulverized and dried and is sold to fertilizer manufacturers as a filler to prevent fertilizers from becoming acid, for which purpose it has replaced hydrated lime and soda ash to some extent. The dolomite also has plant-food value and a large percentage of the product of this plant is being sold direct to large grove owners who apply it direct for soil sweetening and for liberation of the plant food in the soil.

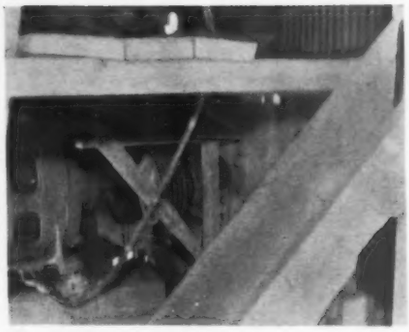
The overburden on this deposit averages about 8 ft. in depth and the deposit about 20 ft. Because of its high moisture content, the deposit is hand-drilled and Austin 40-per cent. dynamite is used. A Koehring gasoline drag-line with a ¾-cu.yd. Page bucket is used for both stripping and loading the rock. A 2½-cu.yd. Maddox skip car is pulled up the incline to the plant by a Maddox single-drum hoist. The rock is discharged into a Maddox single-slugger-roll crusher which reduces it to about 2-in. size. This material then drops into a Georgia Iron Works double-roll crusher below which reduces it to ¾-in. and under. The crushed rock is then discharged into a bin from which it is fed by a short steel slat-conveyor to a 42-in. by 30-ft. Schofield-type rotary drier or roaster. This type of drier is now made by the Taylor Iron Works, Macon, Ga., which recently supplied a new shell for this unit. The drier is fired with fuel oil and the material is passed through it in about 1 min. This exposure is usually sufficient to bring the



The 120-hp. Diesel engine which drives generator supplying power for entire plant. The rotary drier and elevator are at left.



The ring-roll mill used for final grinding of product.



The machine used for preliminary grinding of dried dolomite.

moisture content down to 1 per cent. or less.

The dried dolomite is discharged into a 14-ft. chain bucket-elevator which in turn discharges it on a vibrating screen having ⅛-in. openings. The material retained on this screen is discharged into a new Allis-Chalmers No. 2 Pulverator which is grinding it to ⅛-in. fineness

The preliminary single-slugger-roll crusher under hopper.

at the rate of 12 tons per hr. A 50-ft. chain-bucket-elevator feeds the crusher product to a 3/64-in. screen from which the oversive is fed to an American ring-roll pulverizer. The minus 3/64-in. material from both screens is chuted to bins which have a total capacity of 500 tons. An automatic sacker is used to load the pulverized dolomite into 100-lb. paper valve bags. These bins also have side spouts for loading the product into cars in bulk. The company has

The double-roll secondary crusher which precedes rotary drier.

railway connections to both the Seaboard Airline and Atlantic Coast Line railroads.

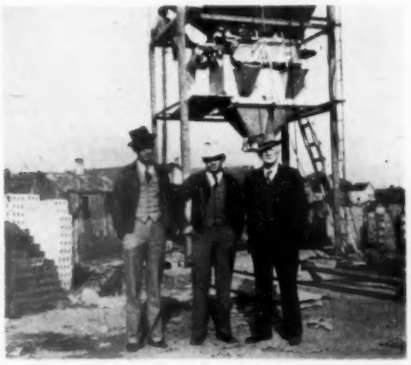
The machinery units in this plant are individually driven by electric motors for which power is supplied by a Diesel-generator unit. A Fairbanks-Morse 2-cyl., 120-hp. Type Y Diesel engine drives a Fairbanks-Morse 90-kv.-a., 3-phase, 60-cycle, 440-v. alternator. A small Goulds centrifugal pump, which supplies cooling water for this engine, is belt-driven from the engine. The drier is driven through a speed-reducer, chain and gear. Most of the other units are driven through Texrope.

The officers of the Florida Dolomite Co. are: S. D. Gooch, president; W. H. Stuart, vice-president; J. K. Stuart, secretary and treasurer.

Oil Boom (from page 59)

the construction of houses, sewers, curbs, etc.

This central-batching plant was designed by the Acme Iron & Wire Works of San Antonio, Tex., which also made or supplied all the plant equipment. J. E. Ingram, president of this company, personally supervised the con-



Messrs. Saller, Coon and Randall of the South Texas Brokerage Co.

struction. This company manufactures belt-conveyors, elevators, screens, complete washing, screening and crushing plants, etc. It also represents in this territory the Chain Belt Co., Northwest Engineering Co., A. Leschen & Sons Rope Co., Ingersoll-Rand Co., Clyde Iron Works, Blaw-Knox Co., Goodyear Tire & Rubber Co., and others.

Install Dust Arrestors in Kansas Cement Plant

★ Three dust-collecting units were installed recently at the Independence, Kan., plant of the Universal Atlas Cement Co. The equipment was designed, built and installed by the Parsons Engineering Co., Cleveland, O.

Belle Isle (from page 52)

The main office of the Belle Isle Lime Co. is at the plant. The officers are: Geo. J. Nicholson, president and treasurer; Theron C. Tayler, vice-president and general manager; C. A. Campbell,

Vibrating feeder which controls rate of discharge of stone from preheater.

vice-president; G. M. Nicholson, secretary. M. H. McGaffigan is superintendent, and John W. Stockett is chemical technician.

Graham Bros. (from page 54)

a No. 4 Traylor Bulldog gyratory crusher on the opposite side of the bins from the other crushers. The product of this crusher is dumped into a belt-bucket elevator which discharges it into a 3-ft. by 12-ft. triple-jacketed revolving screen located on the same level as the crushed-rock and gravel screens already mentioned. In addition to the main bins a batching plant with a storage capacity of about 800 tons has been constructed. It is fed by a belt-elevator which can be supplied with material from either the plant bins or from stock-piles through a truck hopper.

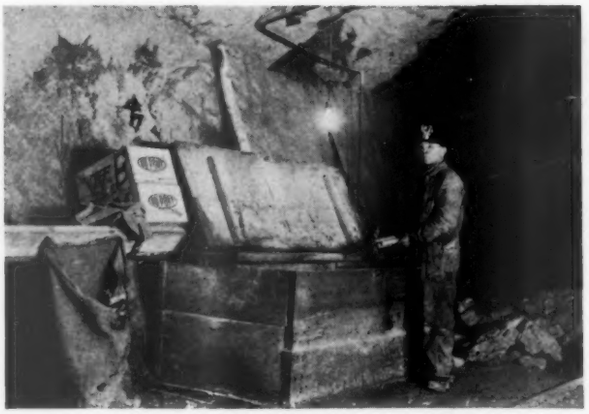
Materials are also removed from the plant bunkers or bins by the same type of equipment. The unit used for this purpose is an 8-cu.yd. Le Tourneau scraper drawn by a 75-hp. Caterpillar Diesel tractor. This equipment makes possible the storage of materials in layers and the tractor has sufficient power to pull a load up slopes 40 per cent. or more in grade.

The same unit is used to reclaim materials from the stock-pile and to discharge them into a reclamation hopper which is equipped with a reciprocating-plate feeder and a short transfer belt-conveyor. The latter discharges its load on the storage belt-conveyor, which can also be used to transport materials direct from the plant bunkers to the storage and batch bins.

By F. D. BICKEL

MINING LIMESTONE 600 FEET BELOW

General view of the plant of the American Lime & Stone Co., Bellefonte, Pa. In the foreground, left, is the head-frame of the shaft.



Where the miners get their daily supply of explosives; there are two of these magazines, one on each side of the shaft.

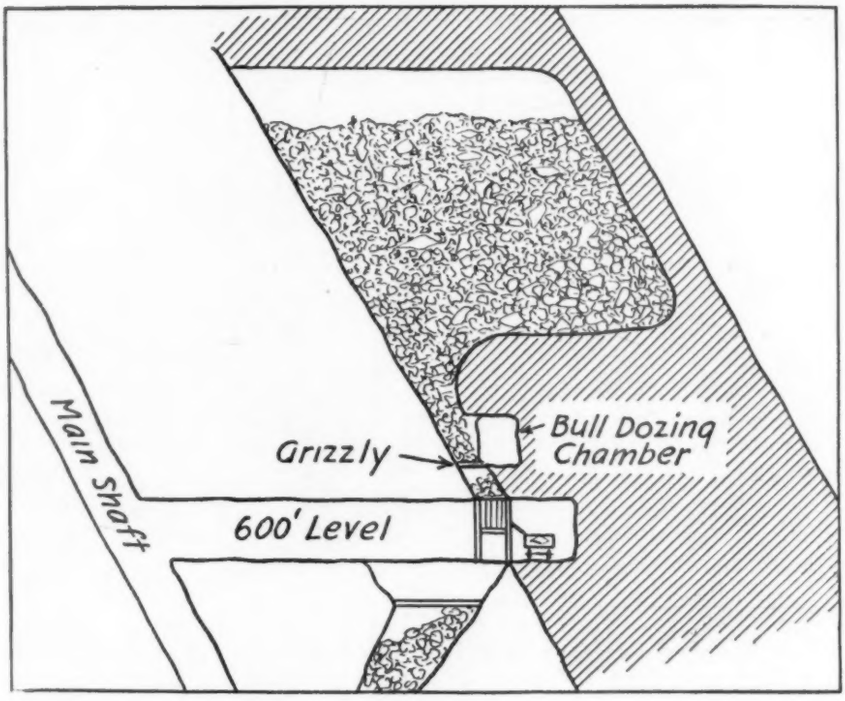
ABOVE—Drilling in one of the stopes, with the miners standing on broken stone blasted from the roof.

Drilling a big one in the "bull-dozing" chamber. Note in the foreground at the left the "grizzly" through which the broken stone goes into the chute.

BELOW—Loading a round in the main drift.

BELOW—A tram-car discharging its load at one of the two main pockets. They are located near the main shaft.

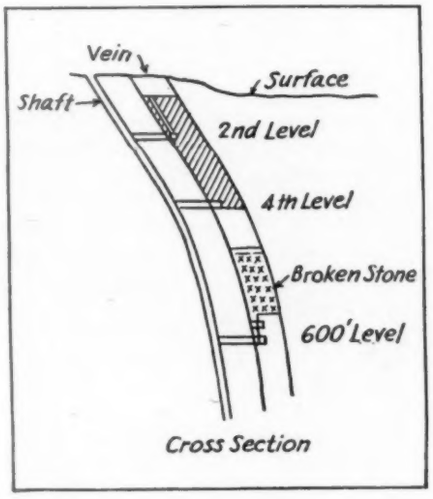
GROUND*



LIMESTONE mines are of two kinds, depending upon the means of approach to them. They are called adit mines, if entrance is made through horizontal tunnels; shaft mines, if they are reached through vertical or nearly vertical passageways. In either case one or more of the following systems is usually employed to mine the stone: Breast stoping, a means of enlarging a horizontal tunnel in a vein until a large room or stope is excavated; the room-and-pillar system, in which the miners work in rooms separated by pillars of solid stone which are left in place for roof support; underhand stoping, in which the miners start at a tunnel level and work down excavating successive layers of stone until the stope is completed; and overhand stoping, in which the miners work upward from a tunnel and remove stone progressively from the roof. The mine operators may resort to one or more of these methods as local conditions require.

Where a vein of limestone inclines sharply, a variation of the overhand method—called shrinkage stoping—is commonly employed. First, a shaft is sunk near and horizontal tunnels are driven into the vein. There the miners attack the roof and construct a "raise" or vertical tunnel leading upward to the proposed location of the stope. This "raise" serves as an outlet for all the limestone mined in the stope. Also, because the miners must have some way to reach their working places, manways are constructed.

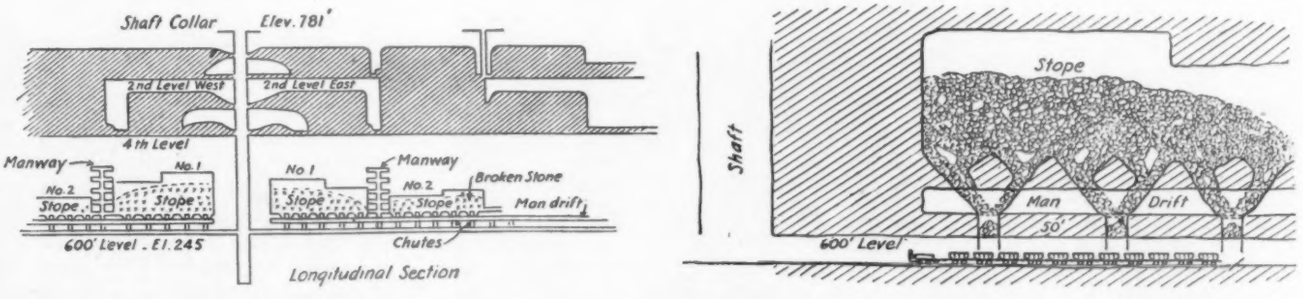
Mining in an overhand stope, as stated before, consists of blasting down the limestone from the roof, but shrinkage stoping introduces a factor which must be taken into account, namely, that a cubic yard of the stone in the roof does not occupy as much space as is required to store the same volume of material blasted down and lying loose on the floor. In short, it is necessary to "shrink" the pile periodically by drawing off broken material from the bottom, so that the miners at the top will have headroom for themselves and their tools. From this practice the method takes its name.



One of the largest operations of this kind is the Belle Mine of the American Lime & Stone Co. at Bellefonte, Pa. The property was originally worked as an open-pit quarry until the limestone strata dipped into the earth so sharply that the cost of removing the overburden became excessive. In 1921 the owners sank a shaft parallel to the vein and then mined the stone by the shrinkage-stoping method just described.

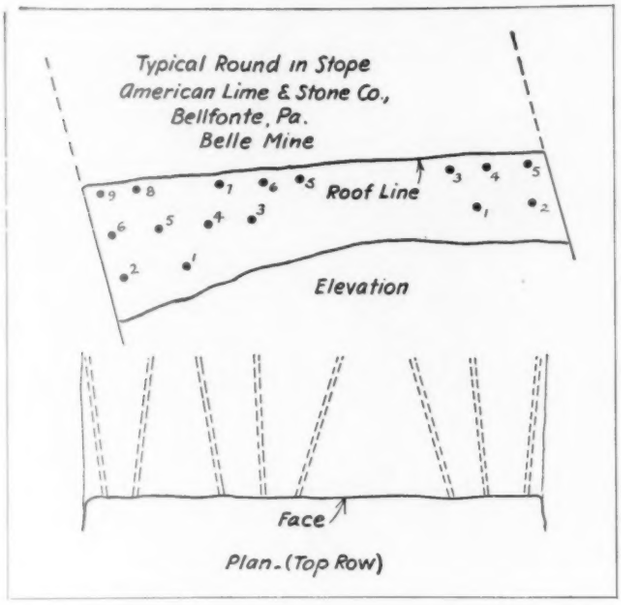
The vein, approximately 63 ft. thick, pitches down from the quarry floor at an angle of 52 deg. at the outcrop, increasing to about 80 deg. at the 600-ft. level where operations are now concentrated.

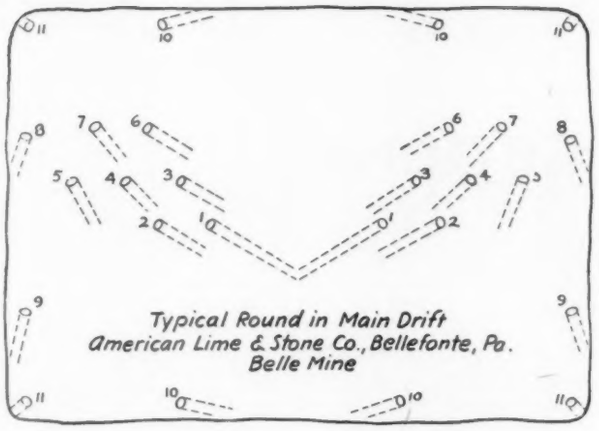
The small sketch above at the left shows a general cross-section view of this mine. The reader will note at the left the main shaft which has been sunk



The sketches above give some idea of the underground workings at the Belle Mine. The drawing at the right illustrates the arrangement of the chutes mentioned in the text.

* Reprinted from *The DuPont Magazine*.





To those familiar with tunneling practices, the above sketch will appear to be somewhat inadequate, because it does not show the depth of the holes or the number of cartridges loaded in each one. These details were left out in order to simplify the drawing. The following table indicates depths and charge per hole:

Holes	Depth in feet	Number of cartridges
1-1	4½	5
2-2	5	5
3-3, 4-4, 5-5	9	7
6-6, 7-7, 8-8	9	6
9-9	9	7
10-10 top	9	6
10-10 bottom	9	7
11-11 top	9	6
11-11 bottom	9	7

more or less parallel to the vein and about 75 ft. away from it. This shaft contains compartments for two skips, a cage for the men and a ladder-way. The tunnels, "raises," manways and stopes at various levels can also be seen. At present all operations are confined to the 600-ft. level.

Recent development work has consisted of sinking the shaft to the 600-ft. level, driving the main "tramming drift" or haulageway into the vein, constructing manways, "raises" and chutes, and opening up six stopes or mining rooms, three on each side of the shaft. The new stopes, when completed, will be 250 ft. long, 210 ft. high and 53 ft. wide, containing approximately 230,000 tons of limestone in the solid, and when full, approximately 140,000 tons of broken stone. About forty per cent. of the daily production from each stope is drawn off each day, as the stope is being filled for reasons that have been explained.

Work at the 600-ft. level has brought into use some new developments based upon the experience gained in working the upper levels, particularly with respect to the facilities for withdrawing stone from the stopes. As is commonly experienced in stope mining, large pieces of rock occasionally choke the chutes. The obvious remedy is to secure a greater uniformity of size before the material is drawn through these passageways. To accomplish this the stone is now drawn off through two large funnel-shaped chutes 25 ft. apart, each pair discharging into opposite sides of a grizzly, or screen, located 20 ft. below the stope on the floor of the bull-dozing chamber.

The grizzlies are constructed of 60-lb. rails which are inverted and set parallel into wooden sills, so as to provide 12-in. openings, through which the small pieces fall. Oversize material is broken down by sledging or block-holing, if necessary, until it, too, falls into the chute. Then it is ready for loading into the mine cars.

The stopes are enlarged by blasting down limestone from the roof in successive stages or layers across the full workable width of the vein. Back and forth the miners proceed from one end to the other, drilling and blasting until the full height is reached. A supporting pillar 40 ft. thick extends from the top of the stope to the floor of the fourth level above it.

At this time the main drift on the 600-ft. level is being constructed both east and west. This tunnel is about 9½ ft. high by 12½ ft. to 13½ ft. wide. A typical round in the face consists of approximately 26 holes—14 cut holes in the center, two holes on each side, and four holes each across the top and bottom, as one of the accompanying sketches shows.

The "raises" are now being driven from the manway, which is 32 ft. above the bottom of the main haulageway, to the floor of the stope. These vertical tunnels are 6 ft. by 7 ft. in dimension and are located in the foot wall. Here, a typical blasting round consists of 16 holes each about 6 ft. deep. Du Pont Gelatin is used and five sticks per hole are loaded and shot to obtain an advance of approximately 5 ft. per round.

For occasional "block-holing" needs at the "grizzly" the miners use 20 per cent. du Pont Gelatin in 1-in. by 8-in. cartridges.

The practice in blasting in the stopes is to drill horizontal holes in the vertical offset of the roof. This forms a face 10 to 12 ft. high, usually extending across the full width of the room. Drifter-type drilling machines mounted on vertical jack posts are rigged up between the top of the pile and the roof, a distance of 10 to 12 ft. A stope crew consists of three miners, each with a machine. One works on the footwall side, another in the center and the third on the hanging wall, each drilling four to seven holes—12 ft. to 16 ft. deep. The explosive used is du Pont "Gelex" 2, in 1¼-in. by 8-in. cartridges. By this means each miner can dislodge from 125 to 150 tons of limestone per day.

The American Lime & Stone Co. operates the Belle Mine and is a subsidiary of the Warner Co. of Philadelphia. S. M. Shallcross is vice-president and general manager, Fred Warner is general superintendent, and Sol Koski, mine captain, is in charge of the working forces.

The limestone mined by this organization is of exceptionally high purity. It is used in the chemical industry and in the building trades; also for furnace and open-hearth stone and for a variety of agricultural needs. The processing of the material is another story leading to a considerable number of special products.

General view of the Monsanto phosphate pit, showing 4-cu.yd. drag-line and two truck-tractor units. The material occurs in veins and pockets around limestone pillars seen in the pit.

By H. K. CHURCH
Sales Engineer,
Euclid Road Machinery Co.

BIG CAPACITY TRACTOR-TRUCKS HAUL PHOSPHATE ROCK FROM PIT TO PLANT

THE Monsanto Chemical Co., Anniston, Ala., is using a new type of phosphate-rock hauling equipment in its Columbia, Tenn., mine. The equipment consists of two Euclid Trac-Truks specially designed for the particular hauling conditions.

The phosphate rock consists of an earthy mixture of earth, clay, and fine phosphorite, the last-mentioned substance being a mixture of minute animal remains and calcium carbonate from the decomposed limestone. The material contains interspersed rocks up to about 24 in. in size.

The material generally occurs in veins or lenses at various angles, which are usually located near the bases of the limestone pillars. It is the practice for the inspector to hand-pick each bucket of material after the overburden has been cast aside and the phosphate rock exposed. The 4-cu.yd. Bucyrus Monighan walking drag-line lends itself admirably to the loading operation. Material is classified as either first grade, light in color and rich in phosphate-rock content, or second grade, dark in color and lean in phosphate rock.

The road is about 2,000 ft. long. It will be lengthened to approximately 2 mi. according to the location of future mining operations. It is approximately level and it is surfaced with a wearing course of road metal of average thickness. The material is dumped at one of three points according to the grade of the material hauled and the requirements of the plant. The three points are the primary-crusher hopper at the plant, into which are dumped both grades of rock according to the requirements of the plant, and the two stock-piles consisting of first- and second-grade rock.

Desirable characteristics in the hauling equipment for such an operation are:

1. Speed; because the length of the haul and the road conditions warrant speed.
2. Flotation; because the soft conditions at the loading point and at the stock-piles call for the minimum wheel pressure.
3. Traction; because the slippery nature of the clayey material at the loading point, on the road, and at the stock-piles, particularly during wet weather, makes traveling very difficult.
4. Capacity; because the large bucket of the walking drag-line requires large-capacity hauling equipment and because of the desirability of maintaining a high ratio of live load to dead load.
5. Dumping simplicity; because of the desire for quick and efficient dumping at both the hopper and the stock-piles.
6. Maneuverability; because of the desired ease of operation at the drag-line and on the stock-piles.

Two Euclid bottom-dump Trac-Truks are being used for hauling. These units are of special design for material handling with wide full-length door openings. The bottom-dump principle

Dumping and turning at the stock-piles. A bulldozer levels and spreads the phosphate ore.

works very effectively at both the hopper and the stock-piles. The units are of 12-cu.yd. water-level capacity and the average load of phosphate rock, weighing approximately 2,000 lb. to the cu. yd., is 12 tons. The Trac-Truks are equipped with large 18-in. by 24-in. tires.

The following studies of hauling operations were made on Oct. 7 and 8, 1936, by the writer. The weather conditions were poor during the study period, there being a continual drizzle of fine rain which made loading, hauling, and dumping conditions at the stock-pile unfavorable. During the study period the Trac-Truks were hauling to the second-grade stock-pile and the drag-line was removing some overburden at the same time.

Truck-tractor units going and coming on a wet and slippery road. Weather conditions do not hamper operations.

The total length of haul, one way, was approximately 2,000 ft. or 0.37 mi. Conditions at the loading point, off the surfaced road, were unfavorable because of the very slippery nature of the clayey top soil. Conditions on the road were pretty fair, although the road was slick in spots by reason of the clay content of the surfacing. Conditions at the dumping point, the second-grade stock-pile, were fair, although the clayey material was fairly slick. The road was approximately level with maximum compensating grades of about 3 per cent.

During the study the drag-line was loading from the most difficult section of the pit and the operator was having some difficulty maneuvering and filling the large bucket. For example, 5.5 min. were required to load the Trac-Truk with an average of 4 bucketfuls, whereas 3 min. are normally required to fill the unit with the contents of 3 fully-loaded buckets in the better sections of the mine. Dumping on the stock-pile was handled quickly and efficiently, 0.2 min. being required for dumping and 0.3 min. for turning. These dumping and turning times hold for the dumping operation at the hopper of the plant, the operation being very similar.

The following average hauling cycle is based on several hours of operation during the two days of the study. Drivers were handling the Trac-Truks in a normal manner and the hauling cycle represents average performance under the particular conditions.

Loading 4 bucketfuls of material, 12 tons or 12 cu. yd.	5.5	min.
Turning at the drag-line	.4	"
Hauling 2,000 ft. at average speed of 10 m.p.h.	2.4	"
Dumping on stock-pile	.2	"
Turning on stock-pile	.3	"
Returning 2,000 ft. at average speed of 11 m.p.h.	2.1	"
Net round-trip time	10.7	min.
Average delay at the drag-line	.4	"
Gross round-trip time	11.1	min.

The distances to both the hopper and the first-grade stock-pile were about 2,000 ft., one way, or approximately equal to the distance to the second-grade stock-pile to which the units were hauling during the study period. In other words, the hauling cycles to all three dumping points were just about equal.

Big drag-line depositing a bucketful of material into a waiting unit.

The above hauling-cycle average was made during a light rain when hauling conditions were bad. During the same shift of 6 hr. of hauling and about 2 hr. of casting, during which casting period the Trac-Truks did not haul, the Trac-Truks hauled 67 loads in 720 Trac-Truk min., giving an average gross round-trip time of 10.7 min. The loading time of 5.5 min., being longer than the usual 3 min., somewhat distorts the hauling-cycle proportions.

As noted above, the actual production during the 6-hr. shift of hauling was:

Trac-Truk hours worked	12.0
Total loads hauled	67
Total tons hauled	804
Loads hauled per Trac-Truk-hr.	5.6
Tons hauled per Trac-Truk-hr	67

The 804 tons hauled during 6 hr. of Trac-Truk operation give an over-all hourly production of 50 tons per Trac-Truk hr. when prorated over the entire 8-hr. shift.

According to the company the record run of the units for the above haul under good hauling conditions is:

Trac-Truk hours worked, exclusive of which the drag-line was casting about one-fourth of the total 12 hr.	18.0
Total loads hauled approximately	125
Total tons hauled	1,500
Loads hauled per Trac-Truk-hr.	7.0
Tons hauled per Trac-Truk-hr.	84

The 1,500 tons hauled during the 9 hr. of Trac-Truk operation give an over-all hourly production of 62 tons per Trac-Truk-hr. when prorated over the entire 12-hr. shift.

Another view of the drag-line bucket dumping into the 12-cu.yd. body.

The company says that the Trac-Truks average about 100 loads during an average 10-hr. day, during which time the drag-line does some casting and the units are idle at the drag-line perhaps one-fifth or one-quarter of the total time. This average production is at the over-all rate of 60 tons per Trac-Truk per hour of the shift. Assuming that the drag-line casts about one-fifth of the time, the actual average production of the Trac-Truks is about 75 tons per Trac-Truk-hr.

Air Hygiene Foundation Develops Program to Curb Dust Diseases

A SIX-POINT program for protecting the health of industrial workers, and a definite plan of medical research designed to help curb industrial disease, is recommended to the Air Hygiene Foundation by its medical committee in a report on *Silicosis and Allied Disorders.*

The committee, headed by Dr. A. J. Lanza, chairman, has attempted to bring together for the first time a practical summary of what is known and what remains to be learned about dust disease. Collaborating with Dr. Lanza in writing the report, which is intended for industrialists as well as physicians, were the seven members of his committee and Miss Eleanor Rantoul, research assistant, Industrial Health Section, Metropolitan Life Insurance Co. Members of the Medical Committee are: Dr. Leroy U. Gardner, Saranac Laboratory, Saranac, N. Y.; Dr. S. R. Haythorn, Singer Memorial Laboratory, Pittsburgh, Pa.; Dr. T. Lyle Hazlett, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; Dr. R. R. Jones, Bell Telephone Co., Pittsburgh, Pa.; Dr. E. P. Pendergrass, University Hospital, Philadelphia, Pa.; Dr. O. A. Sander, consultant, Milwaukee, Wis.; and Dr. R. R. Sayers, U. S. Public Health Service, Washington, D. C.

The report outlines the following program of health control for the guidance of employers:

"A practical program of preëmployment examination of all workers exposed to dust containing silica is essential. Such examinations should include a complete physical examination of each individual, a careful history of past occupational exposure to dust, and a chest Roentgenogram (X-ray).

"The value of such procedure may be summarized thus:

"1. Protection of prospective employees, who may have diseased lungs, from silica exposure.

"2. Discovery of hazardous jobs, as a result of finding the silicosis cases, in order to eradicate these hazards.

"3. Discovery of active and open cases of tuberculosis which are in contact with other employees, especially protecting the younger workers who are susceptible to contact infection.

"4. Discovery, through periodic examination of those with inactive tuberculosis, of any reactivation of their tuberculosis, so as to protect especially the younger employees. This also offers the infected individual a better chance of cure.

"5. Discovery of early cases of silicosis through periodic examination in order to give added protection from further excessive dust exposure.

"6. Determination, through periodic physical examination, of the effectiveness of the dust-control program."

In recommending projects for medical research, the report states:

"There is no phase of employee health which concerns the employer more than does the question of dust diseases, and the ever-increasing extent to which the employees' health is being made a responsibility of the employer demands that every available opportunity for increasing our knowledge be explored.

"The following research projects are listed, therefore, for the consideration of the foundation, whose headquarters are at Mellon Institute:

"(A) Relationship between silicosis and tuberculosis. (B) The effect of other substances upon the action of silica in the body. It is claimed that some substances retard the action of silica on the lungs and that others seem to hasten the silica action. (C) Study of the mechanism by which silica exerts its injurious effects upon the body. Various explanations have been offered, such as that the silica acts physically, or that the action is chemical or physiochemical. (D) Research in the technic of Roentgenography. Since it appears that to an ever-increasing extent preemployment medical examinations will include chest Roentgenograms, a man may be hired or rejected on the basis of his X-ray film. Therefore, the very best technic that can be evolved is the least with which industry can be satisfied."

The report involved the weighing of findings gleaned in a number of industries, in hospitals and in research centers here and abroad. It concludes that on the basis of present knowledge, nine points are definitely known regarding silicosis. They are:

"1. Silicosis results from the inhalation of dust containing free silica.

"2. The time required for development of silicosis varies from a few years to 20 or more, depending on the concentration of silica particles in the air and the length of exposure.

"3. Beginning silicosis is recognizable only by properly-taken Roentgen (X-ray) films of the chest.

"4. Associated with silicosis is a marked predisposition to tuberculosis.

"5. Silicosis can be prevented by protecting the industrial worker from inhaling silica dust. This may be accomplished by engineering measures.

"6. Concentrations to which dust must be reduced in order to be safe have not been absolutely determined.

"7. Industrial dusts, containing silica, are frequently not all silica, being mixed with other materials. Some of these substances may alter the silica action in the body.

"8. Asbestos, a silicate, is the only dust other than free silica which has been shown to cause lung fibrosis and disability.

"9. Simple—that is, uncomplicated—silicosis, as seen in industries in the United States, causes relatively little severe disability."

THE report of the preventive-engineering committee of the Air Hygiene Foundation, written by Prof. Philip Drinker of Harvard, chairman, and other technical specialists on the committee, says that engineers in the "dusty trades" can and should cut heavy dust concentrations below the present limits warranted by medical knowledge. This action is important, the report explains, not only further to safeguard the health of workmen but to give employers the maximum protection against unjust claims.

Discussing methods of determining dusts, the report states that present dust-sampling and dust-estimating methods undoubtedly will be amended and changed from time to time in the light of new knowledge and further experimentation. Where dust control alone is in question, the use of the simplest procedure which will give the necessary information is recommended.

Concerning the size of dust particles, the report observes that much has been made of the fact that particles found in autopsied lungs are of the order of 1 micron (1/25,000 of an inch)—about like common bacteria. It is argued, therefore, that human anatomy and physiology exercise "some phenomenally accurate size grading which excludes larger particles." The report says "there is no reason whatever to look for any such mysterious explanation. The sizing is done in the air before the dust is breathed and not by the man after it has been breathed." It is pointed out that the larger particles tend to fall from the air by their own weight and that "only those small enough to act as part of the transporting air stream are likely ever to reach the lungs."

"In diseases such as silicosis and asbestosis, particles must reach the alveoli (minute air sacs of the lungs) or no silicosis or asbestosis results. In maladies like hay fever the harm is done by particles which may be 15 to 30 microns instead of 1 micron in diameter.

"Toxic dusts, such as lead and manganese, are much more likely to produce ill effects if breathed than if swallowed. The reason for this difference is physiological; it is established and should not be ignored in dust-control problems. Again, common sense tells us that the finer particles of lead are vastly more apt to be breathed than the larger.

"It follows then that dust control for hygienic reasons should be aimed at the fine rather than the coarse particles. Continuing this argument to its logical conclusion, if one could avoid the creation of 1-micron dusts or less, or exclude them from the dust which passes a 325-mesh screen, nearly all dust diseases would be eliminated. This is not at all an academic idea, for dedusting processes are not new and are being applied in many industries. If some of the mechanical ingenuity which is now being applied unthinkingly to creating 1-micron dust were directed to ways for avoiding it, probably it would be discovered that dusts which are too large to be breathed would serve many processes just as well as those which are around 1 micron in size.

"If the breathing of dust causes disability of any sort—silicosis is only one manifestation — then it follows that there must be some degree of air cleanliness from which no disability will result to the average man during the average working period.

"The super-cautious person may claim that the permissible concentrations, commonly called thresholds, are not precise and generally have not been established. This is perfectly true, but emphasizing instead of answering the question is merely passing the responsibility along to the engineer.

"The absurdity of splitting hairs in order to achieve precisely the degree of cleanliness which fits medical knowledge is accentuated when the engineer begins his design work. He does not base his calculations on dust counts, but on the volume of air to be handled, together with the best data he can get on the gross dust loading—cubic feet or thousands of cubic feet per hour and pounds of dust per day. If left to his own devices he will do his best to achieve a dust concentration substantially lower than any medical knowledge warrants. Why, then, wait for the mythical thresholds before taking action."

The report includes a table giving the latest available information on the minimum air velocities necessary in certain industries to insure the maintenance of dust concentrations at safe levels.

The preventive-engineering committee asserts that many firms have neglected heavy dust concentrations in cases where the dust is of no proved harm and adds:

"There is no satisfactory medical answer at present to this question, but the engineer is making a bad mistake if he lets men breathe heavy dust concentrations of any material. If no other reason for dust control can be found, then one should read transcripts of some of the recent suits at common law in which fantastic damages for alleged silicosis were granted to men who breathed dust containing little or no silica. The courts and compensation boards are not impressed with subtle distinctions between dusts with 10 and 40 per cent. quartz, especially when medical experts are reluctant to make definite statements as to the comparative significance of such differences.

"It would be well to realize that men working in dusty trades suffer far more from respiratory troubles of all kinds than do men who work in clean air. The evidence that excessive dustiness of any kind is harmful is beyond argument."

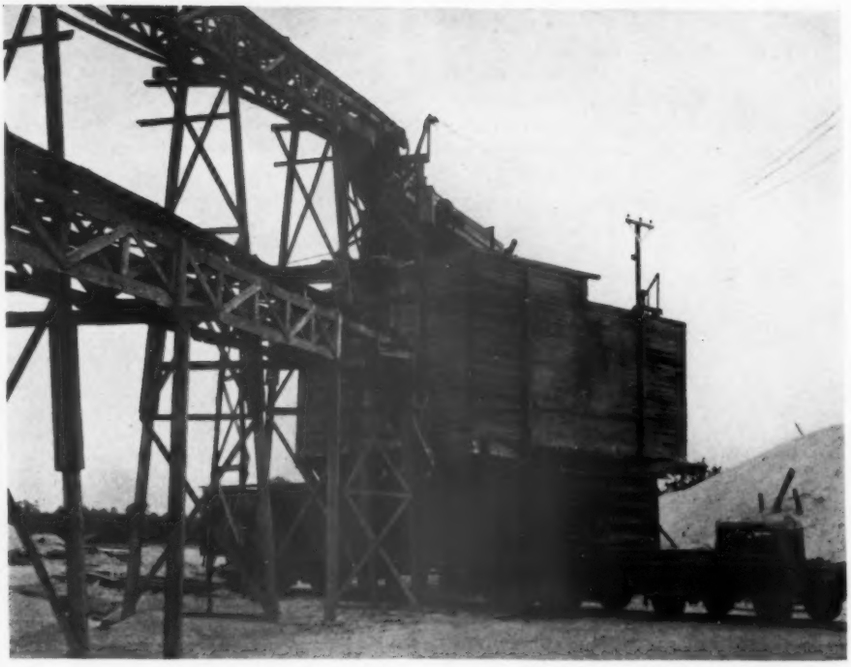
The committee attributes the handicap in this general field to the lack of fundamental data and recommends a number of specific engineering researches for the Foundation to undertake in the coming year.

Besides Prof. Drinker, other members of the Foundation's preventive-engineering committee are Dr. J. M. Dallavalle, U. S. Public Health Service; Theodore F. Hatch, New York State Dept. of Labor; H. M. Nichols, Hyde Park, Mass.; S. C. Vessy, Cleveland; and William P. Yant of Pittsburgh, formerly of the United States Bureau of Mines.

Feldspar Industry Shows Further Gains in 1936

In 1936 the domestic feldspar industry registered substantial improvement over 1935, which, in turn, was well ahead of the previous year. Preliminary figures obtained by the National Feldspar Assn. indicate a 20-per cent. increase over 1935 in shipments of ground feldspar. This increase was attributable largely to improvement in demand for glass making and pottery manufacture, although manufacture of enamels showed an increase of nearly 10 per cent. Significant is the relative increase in the consumption of feldspar in glass making. Whereas only a few years ago the manufacture of glass accounted for only about 30 per cent. of the total consumption of feldspar, it now takes more than all other manufacturing industries combined.

During the year a new competitor for feldspar arose in the form of nepheline syenite. Trial shipments of this material have been imported from Canada, and some of the earlier shipments, particularly those orginating in Bancroft, occasionally ran rather high in iron. Production now, however, comes from Blue Mountain, Methuen Township, where a large, uniform deposit is being prepared for large-scale production. The material is crushed and cleaned magnetically at Lakefield, Ontario, the shipping point. Later, a crushing and cleaning plant may be built in the United States, probably in New York State. At present a duty of 30 per cent. ad valorem, or approximately $3 a ton, is levied on imports of the prepared material, which is ground to pass 28 mesh (13 per cent. through 200 mesh) for use in the glass industry. Ordinary feldspar seldom contains over 18 per cent. alumina, and even South Dakota spar rarely exceeds about 20 per cent. Nepheline-syenite, however, carries 24 per cent. alumina and also contains a slightly higher total amount of alkalies. It is sold in Canada at $10 a ton and is offered at $18.38 delivered at glassworks in western Pennsylvania and Ohio. Another substitute for feldspar may be available soon in the form of a byproduct of certain chemical-manufacturing operations. Preliminary samples indicate the possibility of maintaining a product with the composition of a synthetic sodium-aluminum silicate with over 33 per cent. alumina.



The belt-conveyor above discharges gravel on vibrating screen. The other conveyor discharges sand into cars for shipment.

Aviator-Producer Sells Plane to Keep Gravel Plant Going

THE production of sand and gravel to the average person not engaged in it seems a rather prosaic sort of business in which an inert, uninteresting material is dug out of the ground and rattled around a little in crude machinery before it is shipped. The human interest which lies behind the creation and development of some of these operations has received little publicity and is usually unknown except to producers in their immediate vicinity.

One of the many plants which have histories of real human interest is that of Kivett & Reel, Inc., at Sun, La. L. E. Reel, one of the partners in this business was for fourteen years employed by Gifford-Hill & Co., Inc., as general superintendent of their Louisiana plants. Mr. Reel, a U. S. Army aviator in the world war, did much of his traveling between these plants by airplane (*P&Q*, Sept. 21, 1932, pp. 14-19). In February, 1932, while still in the employ of Gifford-Hill & Co., he acquired the property at Sun, La. The old sand-and-gravel plant on the property was rebuilt and improved to a capacity of 50 tons per hr. The dredge then in use was driven by a 100-hp. Diesel engine, and gasoline engines were used in the plant. Much of the looked-for business did not materialize as soon as was expected and the airplane was sacrificed to keep things going. In 1935, however, business improved and on August 1 of that year Mr. Reel decided to devote his full time to the plant and severed his connection with Gifford-Hill & Co. During a large part of 1936 the plant was operated 24 hr. daily to keep up with orders.

E. H. Kivett, the other partner, was for many years an engineer with the North Carolina State Highway Dept. In 1928, when the highway program there was completed, he accepted the position of chief testing engineer with the Louisiana State Highway Dept. which was then beginning its extensive highway-building program. Early in 1934, when this program was completed, Mr. Kivett became a partner in the firm.

In March, 1936, there was begun another improvement program which has made this plant one of the most efficient in this territory and has also increased its capacity. In March a counterflow steam-engine generator set was replaced by a new 262½-hp. Buckeye Diesel engine and a generator which supply power for the plant and dredge. Steam power had cost $1,300 for one month of 24-hr.-a-day operation. Now, with the Diesel engine, the cost of operation and maintenance averages 0.5 c. per kw.-hr. Under full load pulling about .55 ampere the engine consumes 10 gal. per hr. of 32 to 36 specific-gravity fuel oil costing 5 c. per gal. No special attendant is required and the engine is under the care of the general-plant repair man. A new Niagara vibrating screen and new conveyor belts were installed and the conveyors rearranged. Practically nothing of the old plant was retained except the bins. A 4-in. Fairbanks-Morse pump was installed to supply wash-water for the plant. In September the program was completed by the installation of an Amsco "Counterflow" pump.

The belt-conveyor in foreground receives sand from drag tank. Gravel conveyor above.

The 4-ft. by 12-ft. double-deck vibrating screen used to size gravel.

Only the base and bearings of the old pump were retained.

The company's property consists of 100 acres with an average of 2 ft. of overburden and gravel deposits averaging 35 ft. in depth with about 5 ft. above water-level. The deposit averages about 35 per cent. gravel up to 1½ in. in size. Of the 65 per cent. sand about 60 per cent. is wasted at present. Under this deposit is a 3-ft. bed of white clay under which is another gravel deposit known to be at least 75 ft. in depth.

The dredge is of wooden construction and is 24 ft. wide and 36 ft. long. A wooden A-frame supports the 38-ft. suction pipe which is operated by a 1-drum Domestic hoist. The new 8-in. Amsco pump was being installed at the time of the writer's visit to the plant and the flat-belt drive was being replaced by Gates V-belts. A grooved pulley was installed on the motor shaft but the original flat pulley is retained on the pump shaft. This is a growing practice which is said to be satisfactory where the ratio of reduction is quite large. The 8-in. Amsco "Counterflow" maganese-steel dredge pump is a comparatively recent development which has been described in detail (*P&Q*, Nov., 1936, pp. 73-74). The outstanding feature of this pump is the reduction of internal wear by the introduction of clear water under pressure between the impeller shrouds and the shell side plates. The counterflow action of the clear water keeps sand-laden water from getting between and abrading these parts. In this installation the water is provided by a new 2½-in. Myers centrifugal pump.

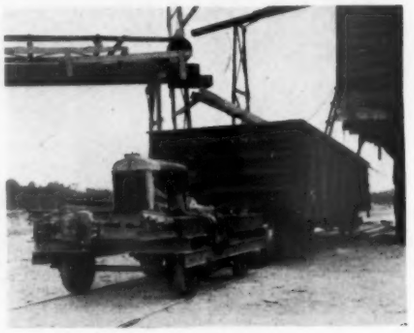
The dredge is now about 200 ft. from the plant and is pumping over 200 tons of sand and gravel per hr. The dredge line discharges vertically upward against a piece of boiler plate in a box at the plant and the sand and gravel drop to the bottom of the box. The outlet level of the box is higher than the bottom, thus forming a bed of material to protect the box against wear. The dredge-line water washes the sand and gravel out of this box and over a stationary screen which has 110 sq. ft. of ¼-in. clear opening Tyloy wire cloth.

Sand passing through this screen drops into a single-chain sand-drag in which it is partially dewatered and much of the fine sand is allowed to overflow to waste. The partially dewatered sand is discharged into a settling tank made from an old steel bin and a batcher scale. Ordinarily the product of this tank is concrete sand, but masons' sand can be obtained by placing a section of 3/16-in. screen cloth over the top of the tank and wasting the oversize. In this case the overflow of water from the drag is cut down so that more water is available to insure accurate settling of this finer product. A 24-in. belt-conveyor 75 ft. long loads the sand direct into railroad cars for shipment.

The gravel retained on the stationary screen drops into a small steel bin from which it is discharged over a ¼-in. stationary screen to insure the removal of the fines and the water. A 24-in. belt-conveyor on 100-ft. centers carries this gravel to the top of the screening plant where it is discharged on a 4-ft. by 12-ft. Tyler Niagara double-deck vibrating screen. The top deck is equipped with 9/16-in. Tyloy screen cloth and the material retained on it goes to bin storage. The bottom deck is equipped with ¼-in. Ton-Cap wire cloth and the material retained on it also goes to the bins. What little material passes through the bottom deck goes to a pile and is sold as seal coat for black-top roads.

The four storage bins hold 60 tons each and the chutes for loading cars below the bins are so arranged that the materials from these bins can be blended while being loaded. Most of the product of this plant is shipped by railway to the New Orleans area, where

The 7-cyl., 262½-hp. Diesel engine with generator which supplies power for all plant and dredge motors. V-belts at right drive the exciter.



The "assembled" gasoline locomotive "spotting" a car at the sand conveyor.

The 8-in. manganese-steel dredge pump with pipe connections for introduction of clear water.

The hydraulic dredge with washing and screening plant, power-house and cooling tower in background.

the company has dealer connections. Some is sold to the Louisiana highway department, local deliveries being made by motor trucks. The company has three White and one Indiana trucks. Excess materials are stock-piled and reloaded by a ½-cu. yd. Brownhoist gasoline crane. A stock-pile loader is also used for this purpose. A gasoline locomotive made from an old Fordson tractor is used for switching cars and for "spotting" them under the bins. The plant has a 1,000-ft. railway connection to the Gulf, Mobile & Northern Ry. and is about 60 mi. by railway northeast of New Orleans.

The Diesel-engine generating building is located near the screening building. The equipment consists of a 7-cyl., 262½-hp. Buckeye Diesel engine operating at 400 r.p.m. direct-connected to an Ideal 2,300-v., 55-amp., 3-phase, 60-cycle, a.-c. generator having a rating of 175 kw. and 219 kv.-a. This supplies power for all the operations with a total of 225-hp. of connected electric motors. A pulley on the end of the generator shaft drives through V-belts a Western Electric d.-c. exciter rated at 15 kw., 137 amp., 115 v. The shaft is supported by a Shafer roller bearing between the generator and the pulley.

Another view of the Diesel engine showing exhaust and cooling-water temperature indicators.

The Diesel engine is the latest type made by the Buckeye Machine Co., and has such features as full-pressure lubrication, completely inclosed construction, and the "Silent Watchman," which automatically stops the engine when the oil or water pressure drops. The instruments include an oil-pressure gage, a selective exhaust-temperature indicator, and direct exhaust-temperature and water-temperature indicators on each cylinder. The fuel oil is stored in a 10,000-gal. tank. A small gasoline engine-driven compressor supplies air for starting the Diesel and a small American pump driven by a 5-hp. electric motor supplies cooling water which is recirculated through a cooling tower. A 4-in. Fairbanks-Morse centrifgal pump, driven by a 25-hp. electric motor of the same make, was recently installed to supply wash-water for the plant. Adjoining the power-house is a repair shop with fairly complete equipment, including an electric-welding set connected to a Hercules gasoline engine.

The dredge pump is driven by a 150-hp. Fairbanks-Morse electric motor, the hoist by a 5-hp. U. S. motor, and the new water pump by a 7½-hp. G. E. motor. At the plant the sand belt-conveyor and drag are driven through a Link-Belt speed-reducer by a 20-hp. G. E. motor. The gravel belt-conveyor is driven through a Link-Belt speed-reducer by a 15-hp. Allis-Chalmers electric motor and the vibrating screen by a 5-hp. U. S. motor through V-belts. United States Rubber Co. conveyor belting, dredge sleeves and suction hose are used in this plant.

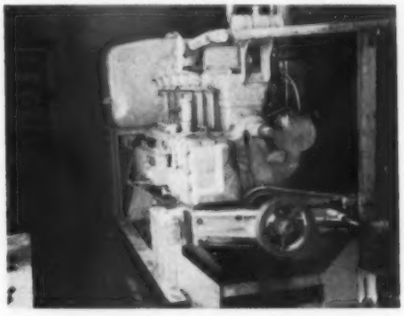
In February, 1935, the company expanded its activities and began to take road contracts, mostly for black-top construction, within the shipping range of this plant. The equipment used in this work includes two Caterpillar 60 tractors, two 10-ft. blades and a Koehring 1-cu. yd. drag-line. A 5-cu. yd. Continental wagon scraper with one of the tractors is used to remove overburden from the deposit when not needed on contracts.

Gypsum-Plaster Plant Employs Diesel Power

One of the oldest mills of its kind, the Pyramid Gypsum Plaster Co., of Levan, Utah, is nearing the end of its first year with Diesel power, according to A. B. Smith, manager.

For many of its thirty years of operation the concern operated its machinery by water power, but about three years ago installed a 125-h.p. steam engine and a boiler of 150 h.p. The plant, according to Mr. Smith, was operated for only two years and then discarded in favor of Diesel equipment.

Delivered fuel oil to this out-of-the-way mill at an altitude of 5,050 ft. costs 11¼c. per gal. But even at that with



Diesel engine which operates plant through line-shafting.

fuel consumption at only 3½ gal. per hr. the operating cost is only 45.2c. per hr. This includes lubricating oil expense.

The Caterpillar engine is connected by flat-belt drive to a 56-in. pulley on a jack-shaft for mill shafting. The shaft-driven units in the mill are those for crushing, grinding, calcining, and sacking.

The cooling system is a heat exchanger made from an old copper-tube water heater. It is a closed system cooled by spring water piped in from the neighboring mountain top. The material supply is from an open quarry. Four cars hold two tons each and are run by gravity to the mill. There is a waste loss of only 15 per cent. from mine to sack.

The output of the Pyramid Gypsum Plaster Co. is 600 sacks of 100-lb. each of hard-wall plaster per 9-hr. day.

LEFT—View in quarry showing drilling and hand loading into wagons.

Quarry and Beauty Parlor Both Operated by This Iowa Woman

A SMALL crushed-stone plant of a type found in many sparsely-settled sections of the country where the demand does not justify larger productive capacity is located 4 mi. northwest of Osceola, Ia. In this fertile farming district there are no towns of sufficient size to form important markets for crushed stone and most of the production of this plant is sold for highway work and for agricultural purposes. This quarry was opened about ten years ago and five years later was taken over by Willis Busick. Since his death in a quarry accident in June, 1936, the plant has been operated by his widow who also operates a beauty parlor in Osceola. Mrs. Busick divides her time between these two businesses and finds time personally to sell the output of the plant. Fred F. Musselman is in charge of plant operations.

With the original plant equipment the production of only a very small amount of fine material was possible and this was increased late in 1936 by the installation of a new hammer-mill and a gasoline engine. The plant now has a daily capacity of about 200 tons of crushed stone and the same amount of agricultural limestone. All the shipments are made in motor trucks.

The deposit of high-calcium limestone is covered by an overburden ranging from 2 ft. in depth at the present location of the quarry face up to 25 ft. in the direction in which the face is being developed. This overburden is removed by a Caterpillar 35 tractor hauling a 1½-cu.yd. Tumblebug scraper. The rock ledge is 18 ft. deep and 2 ft. is being left for the quarry floor above the clay and shale substrata. A Hardsocq No. 7 jack-hammer is used for drilling, and blasting is done with du Pont 40-per cent. dynamite. Single-row shots of 12 to 18 holes are made on the 100-ft. long quarry face. Stone is loaded by hand shovels into horse-drawn wagons which haul it about 300 ft. to the plant.

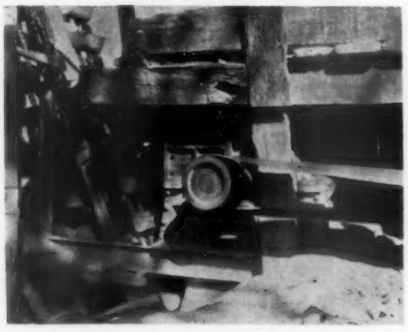
At the plant some of the stone is dumped from the wagons into the new 24-in. Gruendler hammer-mill which is driven through a flat belt by the new Climax 100-hp., 4-cyl. stationary gasoline engine. This machine reduces the stone to a size suitable for agricultural limestone at the rate of about 15 tons per hr. When extra crushed-stone capacity is required this mill can be set to produce from 35 to 50 cu. yd. per hr. of this material. A chain-bucket elevator driven from the crusher shaft raises this material to a 100-ton wooden bin from which it is loaded into trucks.

Stone for the production of crushed stone is dumped into a United Iron Works jaw crusher from which it is discharged into a Weller belt-bucket elevator. The elevator discharges it into a small revolving screen which can grade it to any sizes desired. The finished rock is loaded from a wooden bin into trucks.

When additional capacity for producing agricultural limestone is necessary, the stone can be discharged from the elevator into a hopper from which it goes into a 16-in. pulverizer. Another bucket-elevator discharges the product of this machine into the 100-ton bin previously mentioned. All this equipment is driven by a steam engine.

Mrs. Wm. Busick, owner of the quarry and beauty parlor. Fred Musselman is superintendent of the quarry only.

The 100-hp. gasoline engine which operates the new part of the plant.



The hammer-mill installed to increase the production of agricultural limestone.

Design and Operation of Plants for Producing Stabilized Road Material*

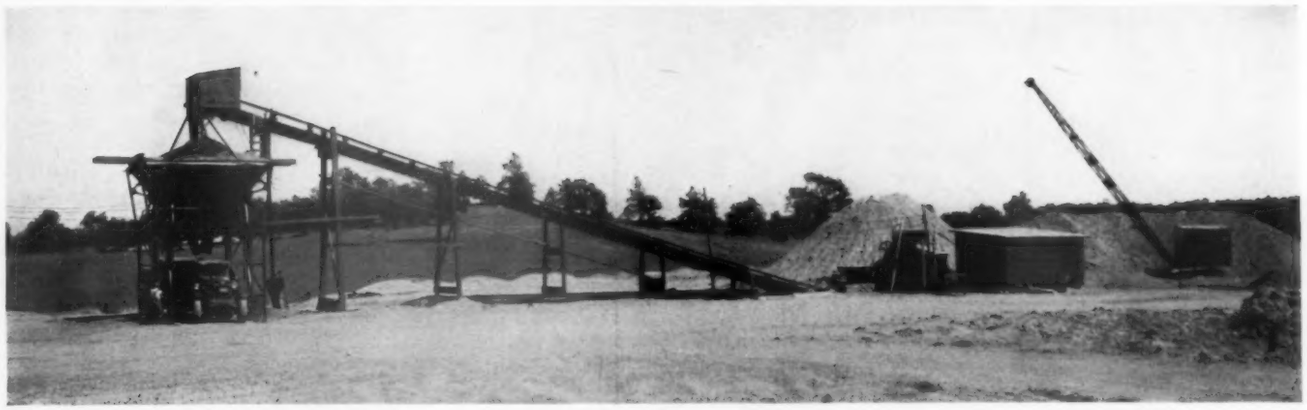


Fig. 1. Simple stabilization plant using clam-shell and pug-mill for mixing.

By LEROY C. STEWART

Dow Chemical Co.

ONE of the more recent developments of soil stabilization is the combining of several types of soil with a chemical admixture in a centralized plant, thereby producing a road-surfacing composition having the soil properties which are necessary to give maximum dry-weather and wet-weather service. Before discussing the design and operation of such a plant it is only logical first to consider the advantages that such a unit affords, as compared with the more common custom of mixing the soils on the surface of the road to make a stabilized mixture.

The highway engineer considers plant-mixing favorably in producing stabilized road material for the following reasons:

1. By means of thorough mixing and accurate control of the composition there is provided a product of uniform composition and hence uniform properties.

2. Expensive and much-needed maintenance equipment is not tied up for mixing operations in construction work.

3. The dust nuisance and annoyance to traffic by construction operations on the road are eliminated.

4. The expense of delays due to waiting for materials to dry after periods of wet weather is abolished.

5. The season during which stabilized roads may be built is materially extended in many parts of the country.

6. Towns, villages, or counties that do not own equipment suitable for carrying on stabilization operations on the road may obtain a complete mix which will give them the desired road properties.

7. Shoulders alongside pavements are somewhat difficult to stabilize in place, but may be made safer and more serviceable by surfacing with the plant-mixed materials.

8. Roads and detours may be put into final service condition more rapidly, due to the speed and ease with which plant material consolidates. This is of great importance where flexible-type paving surfaces are to be applied in the same year.

Producers of aggregates are likewise favorably disposed toward central-plant mixing for the following reasons:

1. Frequently it is possible to utilize at a profit excessive accumulations of a certain size of aggregate by combining it with other available materials.

2. Easily-available overburdens of clay and sand frequently may be incorporated in the plant mix, thereby in many cases profitably getting rid of waste material which has become a nuisance.

3. In large areas of population a substantial retail business may be developed for private drives, cemeteries, parking lots and similar uses.

In relatively-rare instances nature itself, at some time in the prehistoric past, has served as the mixing plant for producing the correct proportions of clay, silt, sand and gravel. In doing so it has provided a road-surfacing composition which requires only the addition of a chemical product which will aid in consolidation and moisture retention in order to meet all the requirements of a stabilized road material. A simple gravity feeder with a plate shut-off may be used satisfactorily to dispense the chemical admixture uniformly to such a soil at some point in the ordinary process of obtaining it from the earth.

Plants for stabilizing soils may be either stationary or portable and their operations may vary depending on local conditions, but essentially their function is to mix the ingredients thoroughly so that the particles of frictional material, such as sand, pebbles and crushed stone or slag, will be coated completely with a film of binder-soil particles which are dampened with the moisture-retaining chemical which is added in the process. In general the scheme of operations involves preparing the binder-soil by putting it through a mechanical device to reduce it to a fine state of subdivision, and mixing this with the proper proportions of fine and coarse aggregate, to which water and chemical have already been added.

* Presented at the sixteenth annual meeting, Highway Research Board, Washington, D. C., Nov. 19 and 20, 1936.

The quality of the binder-soil which is to be used in a stabilization plant usually governs its design. If a highly-cohesive clay, free from sand and silt, is to serve as the bonding medium in the product, the problem of equipment is somewhat complex. If, however, the binder-soil is a friable sand-clay having a plasticity index close to that desired in the ultimate product, the design of the plant becomes quite simple. This latter type of plant is found in several places in Michigan, where several feet of overburden having a plasticity index of from 4 to 10 may be stripped off the gravel and used in combination with coarser aggregate to form a satisfactory mixture.

The simplest plant using such materials as these is one in which a power shovel or clam-shell bucket is used for proportioning the materials. The proper quantities of binder-soil and aggregate are picked alternately from separate piles and placed in a hopper or in another pile, from which the combination is then taken to a pug-mill or other efficient mixing device. The chemical admixture is fed into the mixer at a uniform rate and water is added as necessary, depending on the moisture content of the other materials. Such a plant is shown in Fig. 1.

In general, however, it is better that the binder-soil receive some preliminary treatment to make it coat the coarser aggregate particles more thoroughly during the mixing operation. One method of accomplishing this, which has been used with success, is putting the sand-clay through a vibrating screen as illustrated in Fig. 2. The power shovel dumps the soil on an inclined vibrating screen having openings about 1 in. square. In the case of higher plasticity-index sand-clay the power shovel which digs the strippings may raise and drop them once or twice to shatter the large lumps of soil and thus prepare them to break up easily on the vibrating screen. If large stones are present, these may be removed by means of grizzly bars or by a screen having about 2½-in. openings. The bars are stationary, whereas the coarse screen may be mounted on the vibrating frame above the one with smaller openings. This equipment will break up about 90 per cent. of the binder-soil of relatively-low plasticity index in such a form that it can easily be combined with coarse material in a pug-mill, in which water and chemical admixture are also added.

If a vibrating screen is not already available in an aggregate producer's plant, the investment in such equipment to enable production of stabilized road material is not usually considered as a questionable expenditure, since it also will find much other service in such an environment. Such a screen, operated by a 10-hp. motor, will prepare the low-PI (low-plasticity-index) binder-soil for a plant having a capacity of 50 to 60 tons of finished product per hr.

Fig. 2. Vibrating screen breaking up sand-clay binder soil.

Another common device for preparing the binder-soil, particularly if the latter is highly cohesive, is the so-called disintegrator, which is common in the clay-products industry. In this machine, shown in Fig. 3, the binder-soil is fed between two rolls which operate toward the center. One of the rolls is smaller in diameter than the other, the smaller one being operated at a higher speed and having cutting bars or blades set lengthwise in it. This unit will cut the binder-soil and shred it when the material is damp, and if dry, will more or less powder it. If the clay binder-soil which is being used is deficient in silt, this latter material in the proper amount may be put through the disintegrator along with the clay.

In plants where it is necessary to handle a very cohesive clay, such as one having a plasticity index of 30 or more, the combination of a disintegrator and a smooth-roll crusher works to very good advantage. Such a pit-run clay after leaving the disintegrator is likely to contain small, damp lumps which will not be further broken up to any appreciable extent in subsequent mixing operations. Hence, if this clay is put through a pair of smooth rolls, set with a small clearance and rotating in opposite directions, any dry pieces will be thoroughly pulverized and the damp lumps will be reduced to the form of thin flakes which are more easily cut up by pug-mill blades and which are also broken up by abrasion through the grinding action of the coarse aggregate in any further mixing operations.

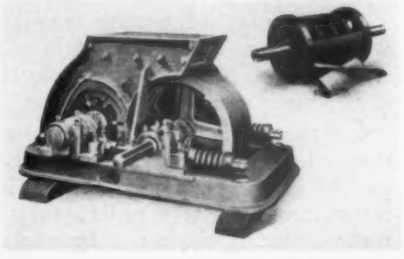


Fig. 3. Disintegrator for preparing highly cohesive clay.

Pug-mills have been used to break up the binder-soil, but unless the latter is quite friable it is necessary to use equipment which has a greater disintegrating effect. Ordinarily hammer-mills are satisfactory for thoroughly-dry binder-soil, but since many plants operate on pit-run material only a few special types can be used. These must be exceptionally high-speed and have some sort of self-cleaning device which will prevent the sticky material from accumulating on the inside of the mill.

The clay-products industry also uses another piece of equipment which prepares clay in a more or less granular form. This is the so-called dry pan, which has a very heavy steel wheel running in a rotating pan. In the bottom of the pan is a slotted plate through which the clay is forced. The plant-stabilized gravel which was put down on the streets of the city of Ames, Ia., during the past two seasons was made with clay prepared in this type of equipment in a brick plant.

At some point in the process it is necessary to measure and feed the binder-soil into the system. One method which has given satisfactory results is to drop charges of the binder-soil into a rectangular box which has slowly-moving screw-feeders at the bottom. Such a piece of equipment is shown in Fig. 4. The screws are arranged so as to draw the material through an adjustable gate which, together with the speed of the screws, controls the quantity and delivers the material, directly or by means of a conveyor belt, to the next piece of equipment. Pit-run clay and silt may be fed to grinding equipment or prepared binder-soil may be fed to mixing machinery by this apparatus. When using pit-run material which may contain occasional stones of large diameter, it is good either to screen out such stones by means of bars across the top of the feeder or to provide shear pins or a slip clutch on the shaft driving the feeder to prevent breaking or twisting of the ribbon screw blades in case such a stone becomes wedged between the screws and the bottom of the feeder. To save

Fig. 4. Binder-soil feeder frequently used in stabilization plants.

time in emptying the feeder when this occurs a hinged door cut into the side of the feeder has been found very valuable.

Crushing and screening of the aggregate as it is originally found is not considered a part of the stabilization-plant operations. Ordinarily the only operation with respect to aggregate is conveying it in measured quantity to the mixing unit. In some plants the sand will be found incorporated with the coarse aggregate, while in others there will be sufficient present in the binder-soil. In still others sand or other type of finer aggregate must be added as a separate constituent. In this case feeding from bins and measuring are the only operations. Screw-feeders or a moving belt along the bottom of the bin will satisfactorily feed such material to another conveying belt or into hoppers. In either case an adjustable gate to regulate the flow of fine aggregate from the bin has been found to be a satisfactory method of measuring. Such an arrangement may be seen in Fig. 5.

Calcium chloride or other admixture is usually admitted into the process by means of gravity feed from a hopper with a controlled opening at the bottom for regulating the flow to conveyor belts or into mixing equipment. Where the capacity of the plant is rather small, so that the feed of the admixture is very light, an agitator or mechanical finger is sometimes necessary to maintain continuous flow. The bottom of a calcium-chloride hopper, together with a sprocket for operating a feeding device, is shown in Fig. 5.

The pug-mill, with a revolving horizontal shaft having cutting knives on it, is the most common mixing device. The knives are set at an angle so as to forward the material from one end to the other, delivering it at the exit end to a hopper or conveyor. The pug-mill ordinarily is the gage of production in the stabilizing plant; in other words, the other pieces of apparatus usually have a wide range of capacity, whereas the pug-mill operates most efficiently, and hence has most steady operation, at a definite rate. The knives of the pug-mill must be composed of, or surfaced with, a very abrasion-resistant steel alloy in order to keep them from wearing too rapidly. A 40-hp. motor should be considered as the minimum for operating an 8-ft. pug-mill for producing about 50 tons of stabilized road material per hr. The pug-mill used in the plant illustrated by Fig. 1 is shown to better advantage in Fig. 6.

The amount of water which is added to the material in the pug-mill during the mixing operation depends on the moisture in the binder and in the aggregate, also on the method of laying down the material on the road. Where the various ingredients are exposed to the weather they pick up considerable quantity of water in rainy weather and it is frequently unnecessary to add any water to the mix. In periods of dry weather, however, a water hose adjusted to introduce a stream of water into the mixture is desirable. In the case of the pug-mill it has been found advantageous to add the water at about the center of the unit. This allows some dry mixing by the blades before the additional water comes in contact with the material. If the material is to be spread by the fanning action from the tail-gate of the truck, the moisture content should be lower than if it is to be dumped by the load on the surface of the road and spread by motor graders. This latter method is perhaps a little more expensive, but due to the increased moisture which may be present it facilitates consolidating the material on the road, particularly in hot, dry weather.

In operating the equipment which has been described the lower the moisture content of the binder-soil, the more satisfactory the operation. In the large plant in Detroit, which turns out 1,500 tons of stabilized slag per day, it was found that in order to get this capacity

Fig. 5. Typical sand and calcium-chloride feeds in stabilization plant.

Fig. 6. Pug-mill mixing constituents of stabilized gravel.

it was advisable to put the pit-run clay through a pug-mill, adding sufficient water to give a thick paste. This is then put through the disintegrator rolls along with the entire amount of aggregate. The rolls are set a couple of inches apart, but with such large quantities of material going through them the aggregate and binder-soil are pressed together, thus giving them a preliminary mixing. Two 12-ft. pug-mills, operating with 75- and 100-hp. motors, are then used to complete the mixing of the materials. The calcium chloride used in this mix is added to the first of these pug-mills at the rate of 16 lb. per cu.yd. The finished mix is quite damp and is loaded out of the pit below the second pug-mill by means of a power shovel.

Probably the first central-mixing plant for producing stabilized soil-bound road material is the one designed and constructed by the Dow Chemical Co., at Midland, Mich. This is shown in Fig. 7. It was built as a demonstration plant for the purpose of studying the various factors which are pertinent to the successful operation of such a plant. It has a maximum capacity of 30 tons of finished mix per hr., but has been operated mostly at 20 to 25 tons per hr. In the two seasons it has been used it has produced more than 25,000 tons of stabilized gravel as well as approximately 1,000 tons of stabilized limestone and slag.

In the demonstration plant the clay which is used has a fairly-high cohesiveness and the quantity used is regulated by the spiral screw-feeder mentioned above. Both a disintegrator and a roll crusher are used to prepare the binder-soil, which is then combined with sand and coarse aggregate (usually pea gravel) in a 7-ft. pug-mill. Up to the point of loading the finished material into the storage hopper wide rubber belts are used for conveying the various constituents; a bucket-conveyor is used on the completed mix. In a small pre-

liminary plant an attempt was made both to mix the ingredients and convey the finished composition by means of a ribbon screw-conveyor in a trough. This was not successful as the damp mix built up a hard mat on the bottom and sides of the trough, causing a binding action which resulted in breaking sprockets, drive chains and even the conveyor shaft itself.

It is believed that the first portable stabilizing plant is the one built by the Pioneer Gravel Equipment Mfg. Co. of Minneapolis, Minn., for the highway department of that state. It combined on a frame on wheels the same equipment mentioned in the previous paragraph. A later model, shown in Fig. 8, has dispensed with the smooth-roll crusher. Such a portable unit has also been used with considerable success by road-construction contractors in Illinois and other states.

Another stabilizing plant of interest is the type used in both 1935 and 1936 in preparing materials for streets in the City of Ames, Ia. The clay which was used was a highly-cohesive material, prepared in a finely-granulated form by means of a dry pan in a near brick plant. Local gravel was used and was mixed with the binder-soil in a 15-cu. ft. concrete mixer the first year, and in a 21-cu. ft. mixer the next year. Calcium chloride from a measuring bucket was added to the materials in the skip of the mixer. The plant had a capacity of 30 to 40 tons of stabilized gravel per hr. In this plant the materials were dry-mixed only, and water was supplied from fire hydrants after the mix had been placed on the street. The blading and rolling operations served to produce a smooth, densely-compacted wearing course.

The plant operations that have been described will produce mixtures in accordance with the design essentials of stable soil mixtures recommended in the 1935 and 1936 Progress Reports of the Project Committee on Stabilized Soil Road Surfaces of the Highway Research Board, which are as follows:

"Materials falling within the following composition limits, by weight, should produce good results:

Passing	Per Cent.
1-in. sieve	100
¾-in. sieve	85 to 100
No. 4 sieve	55 to 85
No. 10 sieve	40 to 65
No. 40 sieve	25 to 50
No. 270 sieve	10 to 25

"Material larger than 1 in. can be used under certain conditions but the amount should not exceed 10 per cent. Also the maximum size should never exceed ⅓ the thickness of the stabilized layer.

"The fraction passing the No. 270 sieve should be less than two-thirds of the fraction passing the No. 40 sieve.

"Generally plasticity indexes of about 3 or less indicate sufficient binder cohesion for roads to be constructed on locations subject to unusually wet conditions; 4 to about 8 for conditions of average moisture; and 9 to 15 inclusive only for the drier or the arid conditions. Plasticity indexes exceeding 15 indicate soils not suitable for this type of construction.

"The presence of the undesirable micaceous, diatomaceous, peaty or other organic substances is indicated by liquid limits greater than those indicated by the expression:

$$LL = 1.6\,PI + 14$$

"The more the liquid limits exceed those values, the more unsatisfactory the soil binder is apt to be due to detrimental sponginess and capillarity. Elimination of such properties in detrimental amount from the final road mixture may be accomplished by keeping the liquid limits from exceeding about 35."

"Suggested limits for base or lower course are as follows:

Passing	Per Cent. By Weight
1½-in. sieve	100
1-in. sieve	85 to 100
¾-in. sieve	65 to 95
½-in. sieve	30 to 85
No. 4 sieve	25 to 70
No. 10 sieve	20 to 50
No. 40 sieve	15 to 30
No. 270 sieve	17 to 20[1]

"The fraction passing the No. 270 sieve should not be more than two-thirds of the fraction passing the No. 40 sieve.

"The material passing the No. 40 sieve should have a plasticity index between 4 and 14[1] and a liquid limit not exceeding 35 as determined by the physical test methods of the United States Bureau of Public Roads (31), or the American Association of State Highway Officials, Standard Specifications for Soil Testing, Method T-89, T-90 and T-91 (31)."

In order to prevent the undesirable combination of a high amount of soil fines and a high plasticity index the Calcium Chloride Assn. recommends further that the sum of the percentage of the material passing the 40-mesh sieve and the plasticity index of this fraction shall not exceed 40.

In proportioning the materials which are combined to form a mixture complying with the above specifications the particle-size grading of the binder-soil and of the aggregate governs the ratio of the quantities which are used. Sieve analyses of the various materials and plasticity-index determinations of the binder-soil are all that are required to calculate the proportions. In general sandy clay requires clean, non-sandy coarse aggregate, whereas highly-plastic clay binder requires fine sand as well as coarser aggregate, and in many cases the stability of the final product is improved if silt is also incorporated in the mix. It is of particular importance that the recommendation of the Calcium Chloride Assn. be observed. This states that the sum of the percentage of the material passing the 40-mesh sieve and the plasticity index of the fraction shall not exceed 40. This insures a material which will not become unduly sloppy on the surface of the road under traffic in wet weather.

The laboratory testing which is neces-

Fig. 7. Stabilization plant built for demonstration purposes by the Dow Chemical Co., Midland, Mich.

[1] From recent observations in Indiana it appears that for stabilized bases the percentage passing the No. 270 sieve should be from 7 to 15 and the plasticity index should be less than 9.

Fig. 8. Portable stabilization plant built by the Pioneer Gravel Equipment Mfg. Co.

sary to control the operation of a stabilization plant satisfactorily is relatively simple. Sieve analysis of the dried product, using ¾-in., Nos. 4, 10 and 40 sieves, and a quick method for determining the plasticity index are all that are necessary to check the uniformity of production. Of course, an occasional sample should be subjected to complete physical and mechanical tests. This is particularly true if the source of the binder-soil is changed.

There is no particular short-cut in making the control sieve analysis except oven-drying at 110 deg. F. and using only the four siezes mentioned above. The quick method which we have developed for determining plastic and liquid limits, the difference of which is the plasticity index, may be worth mentioning at this point. The actual manipulation of the moistened soil sample in each of the soil tests is the same as the standard A. S. T. M. and A. A. S. H. O. methods. The benefit lies in the elimination of the time, effort and equipment required for oven-drying and accurate weighing in the usual method of determining quantitatively the moisture present in wetted soil samples.

In these rapid tests a sample weighing 33.3 grams is taken from the dry, thoroughly-mixed portion of the material passing the No. 40 sieve and is subjected to the standard test operations. When adding the water, however, it is measured from a burette in increments until the end-point of the test is reached. The test value being sought is equal to three times the number of cubic centimeters of the water which is used.

The end-point of the tests should be approached from the dry side and if it is exceeded the sample must be discarded and a new one prepared with less water added. With a little experience, however, the technique can be developed so there will be no need of repeating the operations. Preliminary tests on samples, the test values of which are known, will aid in developing this technique. To be reasonably reliable each test should not take longer than 4 min. and there should be no appreciable breeze blowing across the mixing dish, or some drying, which may increase the test value somewhat, may take place.

The cost of producing plant-mixed stabilized soil-bound road material will depend on local conditions, both from the standpoint of investment and of operating costs. Often an aggregate producer will build such a plant to use either strippings or aggregates which otherwise are of limited value to him. Hence, he must figure to offset the investment in any new equipment with the increased income from such raw materials. Often such savings also make it possible for him to include the chemical admixture at little or no increase in the price of the finished product as compared with material which he has sold previously for road purposes.

If an easily-prepared sand-clay binder-soil can be obtained cheaply, a pug-mill with a motor and a home-made feeder for the chemical admixture is about all the new equipment he may need and will cost less than a thousand dollars. Storage bins and conveying and handling equipment, when not already available, involve an extra investment of several hundred dollars. When a vibrating screen or disintegrator is required for preparing the binder-soil and a screw-feeder is used to regulate its flow into the process another couple of thousand dollars are likely to be involved by the time these units are fitted with motors and conveyor belts.

The labor required to operate a stabilization plant necessarily will vary, depending upon the amount of equipment required to handle the local materials. Usually one man can operate the equipment other than power shovels and trucks. If a vibrating screen is used for breaking up the binder-soil, this is likely to be located at the pit, which may be some distance from the rest of the plant and may require the services of an extra man. In general, however, the labor costs, as well as the costs of power and materials, will be such that the product can be sold for 65c. to $1 per ton at the plant, and can compete favorably with material sold under specifications which were adopted before the benefits of stabilization became so widely recognized.

Modern Methods Used in This Pit

Instead of moving their hoppers, conveyor-belts, flumes, etc., the Independent Sand & Gravel Co., Port Washington, N. Y., extends its borrow pits lengthwise and uses a Caterpillar Diesel engine with LaPlant-Choate bulldozer to bring sand and gravel in from the sides. The bulldozer strips off top soil while the shovel loads materials within reach in pit, then the bulldozer pushes gravel from the sides for about 200 ft. to a point where the shovel can reach it.

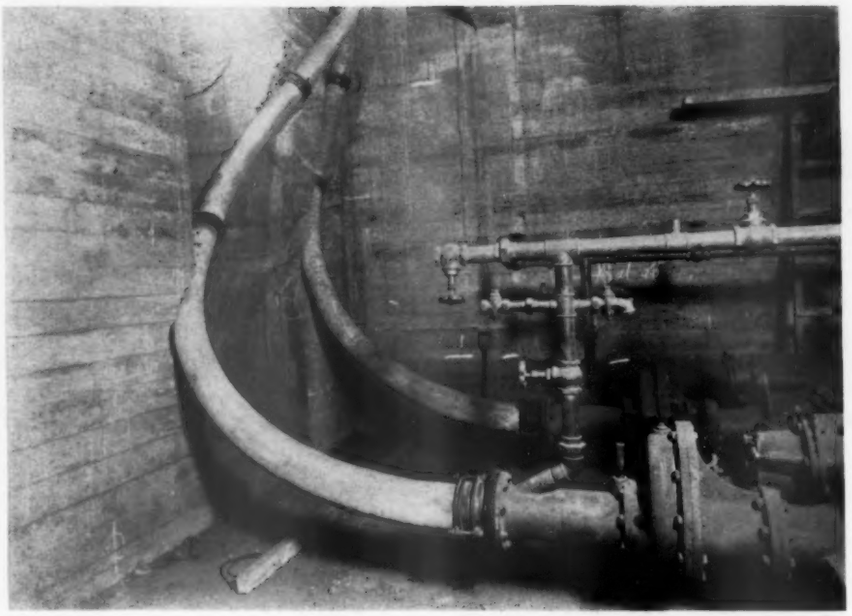


Fig. 1. Six-inch cement-asbestos pipe in a Fuller-Kinyon conveying system transporting raw material in a cement plant in Spain.

Industry Finds Extensive Uses for Cement-Asbestos Products

By J. M. ALONZO

A VERY interesting type of concrete pipe and sheet has been used in Europe for some years and its manufacture has developed into a very important industry. The writer had an opportunity of studying this product in Spain, where it is manufactured under the trade name of "Uralita" and where its use is becoming very popular. In other countries this patented product is manufactured under the names of "Eternit," "Ternolit," "Asbelit," "Fulgurit," etc. The composition of this product is asbestos fiber and Portland cement thoroughly mixed and made into a special kind of concrete by the addition of the proper amount of water as will be explained later.

At first this material was used mostly as a roofing product in the shape of sheets and shingles, but its light weight, and its resistance to fire, water, and freezing weather, together with the fact that it can be sawed, nailed, perforated, enameled and polished, soon made it a very popular building material. It also has a very high mechanical resistance. Recently its use has extended to other fields, of which the most interesting are the manufacture of pipes and sheets.

The manufacture of this product is fairly simple. The most important part is the selection and preparation of the asbestos, as it is essential that it be very fibrous. It is first ground in a roller mill, during which operation the fibers are shredded, this taking from 10 to 40 min. The fibers then pass into a hammer-mill where they are broken down further. They are then carefully weighed and the correct amount is fed to a pug-mill. Here Portland cement is added, having also been weighed in separate scales so that the proper proportion of asbestos and cement is present in the pug-mill. The two materials are then thoroughly mixed and while the mixing is taking place water is added in sufficient quantity to make a very liquid slurry. If color is desired, the coloring medium is added at this stage.

The slurry then passes into a mixing basin provided with paddles or agitators and is fed to the finishing machine which is the most important unit in the process, as the quality of the product and the output of the plant depend very much on the performance of this machine. This machine somewhat resembles the machines used in the manufacture of paper. The slurry or paste is run on wire screens and is fed to a wide endless belt made of felt, where it spreads in a very thin uniform layer. A series of suction ports under the belt are provided at several points along its path, so that the greater part of the water is removed as the belt moves toward the compression cylinders. The damp paste is then picked up by a rotating drum to which it adheres in a very thin layer about .008 in. thick and it is rolled around this drum until it builds up to the desired thickness of the product to be obtained. While the paste is being rolled on the drum it is being compacted by means of cylinders pressing against the drum along its entire length. The high compression to which they are subjected makes the several layers bind tightly and eliminates all the voids or air pockets and any lumps that may be present due to foreign matter that might have passed through the screens.

Thus far the process is the same for manufacturing pipes or sheets. When sheets are being made, the drum on which the paste is to be rolled is of a large diameter and its length corresponds to the length of the sheet. After the paste has been built up on the drum to the desired thickness (which is the thickness of the sheet to be obtained) it is slit lengthwise and the drum is removed and the damp paste is spread out on a flat belt that takes it to the cutting machine. Here it is cut to the desired size for shingles or sheets and the edges are beveled. The sheets are then stacked and taken to a large press where more of the water is eliminated by compression and they are stacked once more and taken to the drying chambers, where they remain 12 to 14 hr. As they come out they are once more trimmed to the proper size to do away with any ragged edges, and at the same time they are drilled. They are then taken to the curing room where they are left for 28 days to allow the concrete to set and acquire its full strength.

When manufacturing pipe, the paste is rolled around a metal cylinder or core having an outside diameter equal to the inside diameter of the pipe to be made. The paste is wrapped around this core until the proper thickness of pipe has been obtained. When this point has been reached the metal core is removed and a wooden core of the same diameter is inserted in its place, this cylinder remaining inside the pipe during the process of drying. Once it is dry, the pipe is taken to a large basin, where it is submerged in water for 15 days, after which time it is taken

to the curing room, where it is left for 5 weeks. The pipe is then finished smooth and tested with great care.

The material washed out with the water during the manufacturing process is reclaimed and fed back to the pug-mill and here it is mixed with the fresh material.

The length of the pipes is the same as that of the metal core and of the felt belt of the machine. The machine used in the plant of "Uralita" can turn out pipe 4 m. (13.12 ft.) in length. The thickness depends, of course, on the required strength of the pipe and is a factor of the pressure to which the pipe is to be subjected. The inside working pressure may be anything up to 15 atmospheres (220 lb. per sq. in.). The thickness may be anything from 5/16 to 2⅜ in. and the pipes are made in diameters of 2 to 39 in.

This pipe is becoming very popular for water and gas lines because it does not rust or corrode and is free from electrolytic trouble when buried. It is not porous and is very light, while at the same time it is extremely resistant to compression, traction and shock. It is quite smooth inside and perfectly round and calibrated as to inside diameter and thickness. Finally, it is cheap to buy and cheap to install because it is easily cut to any size in the field, is easy to handle and does not require deep trenches when buried, or a thick bed on which to lay it as it is so elastic and strong that outside compression does not affect it. Neither is it affected by changes in temperature.

An interesting use is shown in Figs. 1, 2, 3 and 4 in connection with a Fuller-Kinyon conveying system transporting cement raw material in a cement plant in Spain. This particular pipe is 6 in. in inside diameter. Its cost was about one-third that of steel pipe in that country. It was calibrated for an operating inside pressure of 147 lb. per sq. in. and has a thickness of 9/16 in. and a weight of 12 lb. per lineal ft. The bends in this transport line were all made in the same way as the straight pipe and bent to a radius of about 10 ft. Couplings of any standard type can be used, but the installation described uses the "Gibault" coupling, as shown in Figs. 5 and 6, consisting of a metal sleeve, two rubber rings and two loose flanges. The flanges are bolted together and clamp the sleeve, squeezing the rubber rings to make the joint tight.

Another type of union used is the "Simplex" coupling consisting of a sleeve made of the same material as the pipe, and two rubber rings. The sleeve is made to slide over the rubber rings as shown in Fig. 7. This union requires a special tool for its installation. Elbows, tees and other fittings are made of cast iron.

Fig. 4. Piping delivering raw material to blending tanks and to kiln bin. The screw conveyor is the old installation leading to the kiln bin.

Fig. 2. The two-way distributing valves are of cast iron but the bends are all of concrete-asbestos pipe.

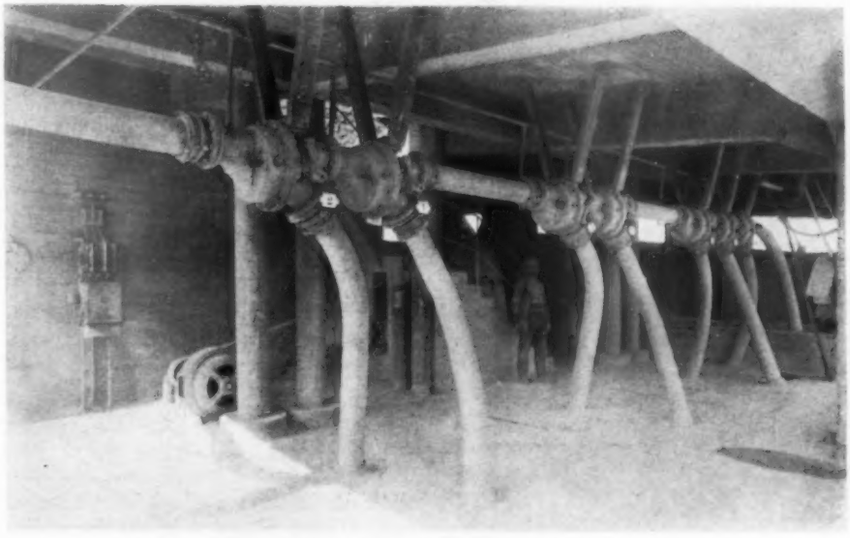


Fig. 3. Distributing branches over the silos.

Fig. 5. Gibault union before assembling.

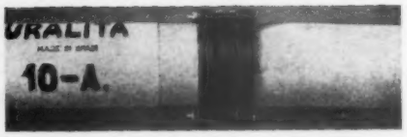


Fig. 6. Gibault union assembled.

The pipe shows up remarkably well under different tests. A 6-in. i.-d. pipe with a wall thickness of 19/32 in. was filled with water and a hydrostatic load of 470 lb. per sq. in. was applied without breakage of the tube. An 8-in. pipe with a wall thickness of ½ in. broke only under a hydrostatic pressure of 412 lb. per sq. in., equivalent to a stress of 3,058 lb. per sq. in. This

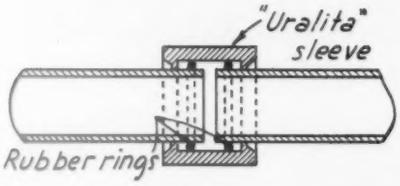


Fig. 7.

shows the high tensions supported, which are due to the presence of the fibers acting similarly to the reinforcing in reinforced concrete. This, added to the severe compression that the concrete is subjected to while it is being wound around the solid nucleus, a compression which takes place uniformly and constantly, gives it a very high compactness and accounts for the high compression and tension stresses obtained.

To test its flexibility a pipe of 9⅞-in. i. d. and walls of ¾-in. thickness, was placed on supports 6 ft. apart. The pipe failed under a load of 15,917 lb. applied in its center through a wooden block 4 in. wide.

Fig. 8. Concrete beams before placing Uralita cover.

Fig. 9. Uralita cover in place.

Some interesting tests were made to show that these pipes are absolutely waterproof. Water was injected inside a pipe of 2-in. diameter until a pressure of 213 lb. per sq. in. was obtained and maintained during 14 hr., after which no signs of sweating were found on the outer wall of the pipe. Another test was run in which water with a coloring pigment was injected at a pressure 50 per cent. higher than the pressure for which the pipe was calibrated. This pressure was kept up for 8 hr., at the end of which time the pressure was increased until the pipe broke. Pieces were then examined with a microscope to determine how far the coloring matter had entered into the pipe and it was found that it had penetrated to a depth of only .002 in., showing that the pipes are practically non-porous. This makes them very acceptable for water and gas lines.

Tests to determine the tensile stress gave an average of 2,775 lb. per sq. in. for breaking strength. Compression tests made on cubes formed with the material of the pipes, and in the longitudinal direction of the pipe, showed a breaking strength of 14,394 lb. per sq. in. Compression tests of the pipe made in the direction of the radius of the pipe gave the following results:

Length of the Pipe (in.)	Inside Diameter	Thickness (in.)	Total Breaking Strength (lb.)
20	8	1	14,960
20	6	⅝	12,320
20	12	1¼	23,320

The loads were applied by means of square-edge plates, 4 in. by ⅜ in. by 20 ft. long.

Crushing loads applied on the pipes in a radial direction showed:

Length of the Pipe (in.)	Inside Diameter (in.)	Thickness (in.)	Total Breaking Strength (lb.)
20	4	7/16	9,306
20	8	19/32	13,200
20	6	⅝	15,950
20	4	23/32	22,220
20	8	1	34,430

The loads were transmitted through two wooden blocks, each 12 in. long.

Another use of this concrete-asbestos product is for plain or corrugated sheets for walls or roofs. It stands the heat and the cold very well and the fact that it is fireproof makes it highly suitable for garages, warehouses, etc. It is easy to cut and drill in the field.

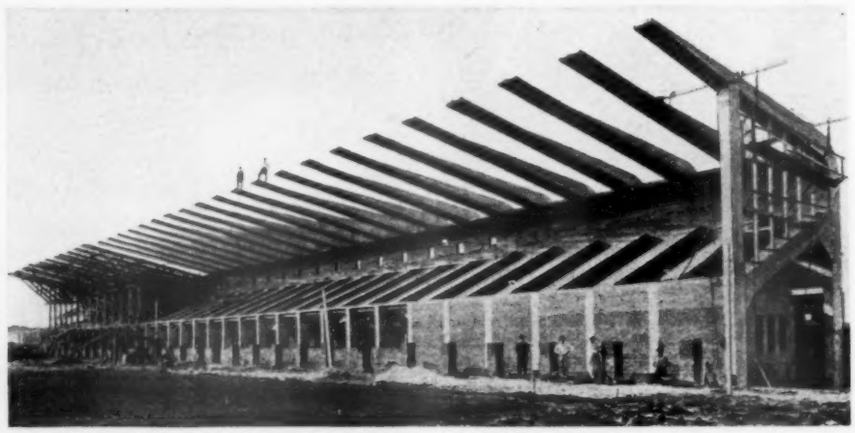


Fig. 10. Concrete beams ready to receive cover made of Uralita arches. These beams have a 50-ft. span.

Finally, it is being used as a roofing material in special cases where it is desired to have a light, waterproof and highly-resistant material. The plates are very light as they can be quite thin because of the strength of the material. Figs. 8, 9 and 10 show arches of "Uralita" plate spanning the gaps between reinforced-concrete beams in a market in Spain. The span of the arches is 8 ft. plus and the plates are 13/32 in. thick and a person can walk over this roof with perfect safety. Not one of these plates broke during erection. They are a very practical solution for covering roofs with long eaves (Fig. 10) as these can be made to the shape of an inverted "T" as shown in Fig. 11. The water can run down the depression on the wing of the "T" and the "Uralita" plate is placed over the beam, resting on a strip of canvas thoroughly impregnated in tar. The plate is fastened down as shown.

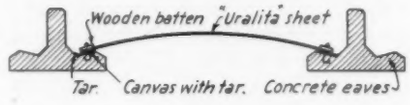


Fig. 11.

The new all-steel plant of the Southern Rock Asphalt Co. near Dougherty, Okla.

Rebuilds Plant of Concrete and Steel After Destruction by Fire

View in the main limestone rock asphalt quarry showing methods of loading and haulage used.

ONE of the things most dreaded by plant operators is an enforced shutdown at a time when the full output of the plant is required to meet the demand for its product. Usually it takes a fire, flood or similar catastrophe to create such a condition. This was the position in which the Southern Rock Asphalt Co. found itself when its plant at Dougherty, Okla., was completely destroyed by fire on June 19, 1936. Two hammer-mills were the only equipment salvaged from the burned plant and only a small part of the loss was covered by insurance. Important improvements had been made to this plant late in 1934 (*P&Q*, September, 1935, pp. 35-36). This plant had a capacity of 75 tons per hr. and was of wooden construction.

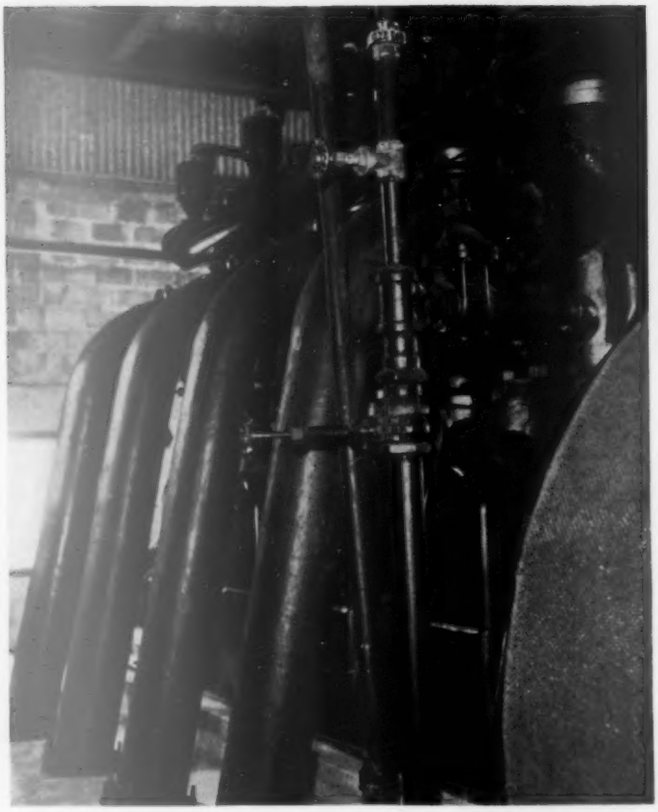
Because of the urgent demand for its product at that time a temporary plant was hurriedly assembled and went into operation three days after the fire. This plant had an output of 1,000 tons daily and was operated until a completely new plant could be built.

The present plant has a capacity of 150 tons per hr. and went into operation on Sept. 1, 1936. It is of concrete-and-steel construction with corrugated sheet-metal siding and roofing. All the equipment, with the exception of the two hammer-mills already mentioned, is new. The plant was designed by the company with the aid of the manufacturers supplying the important equipment. Its outstanding features are the method of automatically blending, by weight proportioning, several grades of material to meet any desired specification and the operation of the entire plant by a single Diesel engine. Roller-bearings are used in practically all the equipment.

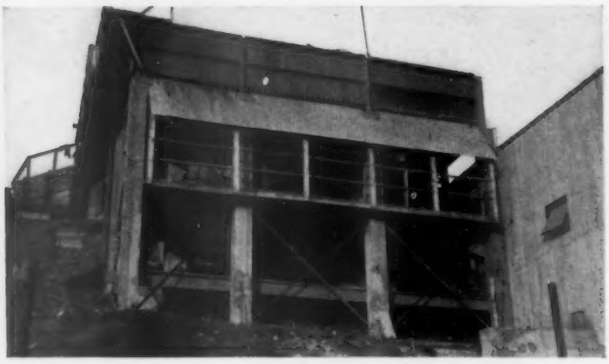
Operations outside the plant remain unchanged since the previous article was published and as they were then described in detail only a brief account will be given. The product of this plant is a blend of two distinct types of material, natural asphaltic sand and asphaltic limestone. The sand is obtained from pits about 6 mi. from the plant and has a bitumen content of from 10 to 12 per cent. The overburden is heavy and is loaded by shovels and hauled away by 15 Ford and International trucks owned by the company. Sand is loaded by power and hand shovels into motor trucks which haul it to the plant. This hauling is paid for by the ton and each load is weighed at the plant on a Fairbanks truck scale. The 7 shovels used at the pit are owned by the company.

Most of the asphalt rock used is still obtained from the old original quarry and the methods used for drilling, blasting and loading here are those described in the previous article. Rock from this quarry has a bitumen content of from 3 to 4 per cent. A new quarry opened in 1935 supplies rock with a higher bitumen content. Drilling in this quarry is done with jack-hammers, and 40-per cent. Hercules dynamite is used for blasting. In both quarries the loading is done by hand into small dump cars which are hauled about ½ mi. to the plant by mules and by gravity. Most of the 450 men employed by the company are engaged in hand loading at the pits and quarries.

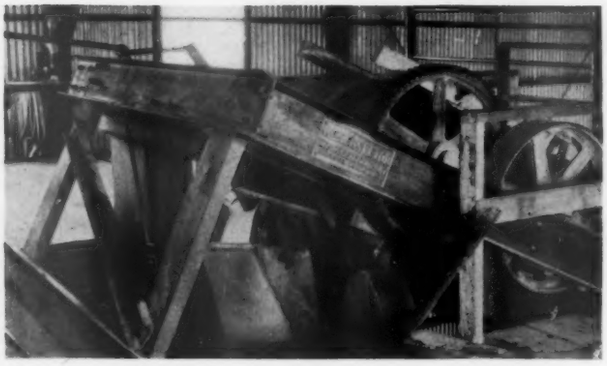
At the plant the asphaltic sand and the two grades of rock asphalt are blended by C. S. Johnson Co. automatic weigh-batchers specially built for weighing asphaltic materials. At the plant is a 3-compartment Johnson bin with a 1,500-lb. automatic weigh-batcher under each compartment and over a pan-conveyor which feeds the primary hammer-mill. The batchers have air-electric operated radial-type filling gates, with choker weights for jam-proof closing, and air-operated discharge gates. The batch hoppers are suspended on scales which regulate the flow and the filling of each batcher to the specific weight through the means of an auto-



Exhaust side of Diesel engine which drives entire plant. Main drive belt is at right.



The bins and batching plant which blend limestone rock asphalt and asphaltic sandstone.



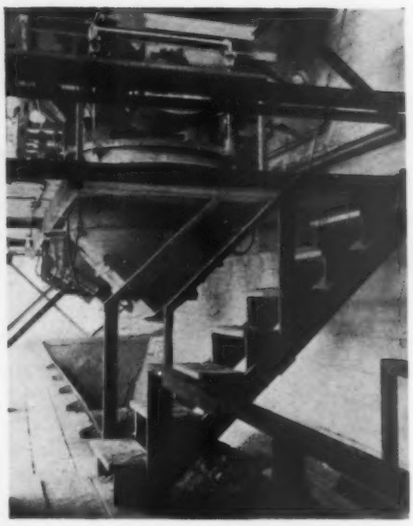
Belt and gear drive of belt-conveyor feeding screens.

The hammer-mill which recrushes oversize from sizing screens.

The final sizing screen from which oversize is discharged to return belt-conveyor.

The two coarse-sizing screens from which throughs pass to final screen.

BELOW: Auxiliary gasoline-engine drive of air-compressor. RIGHT: Some of the workers and trucks in one of the asphaltic-sandstone quarries.

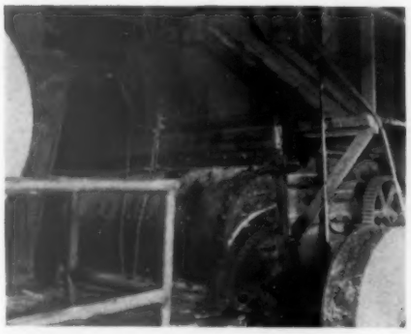


The raw material weighing batchers which discharge on pan conveyor below.

matic shuttle-gate operation and major and final feed control. But for the occasional checking by the blending plant attendant, this system functions automatically and requires no attention except when a change to another specification is desired.

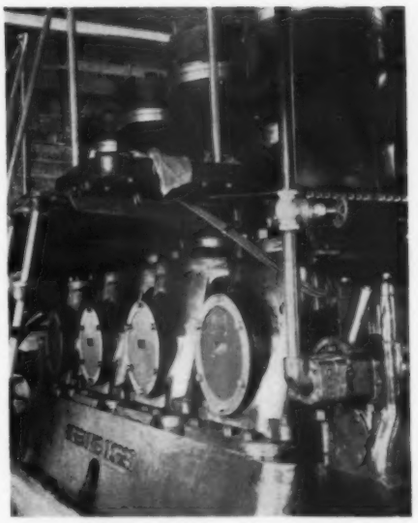
The Chain-Belt pan-conveyor which collects the batched materials is 30 in. wide and 36 ft. long and is operated at a speed of 5 ft. per min. It discharges its load into the 56-in. Williams primary hammer-mill. A 30-in. by 84-ft. inclined Chain-Belt belt-conveyor carries the crusher product to the top of the screening building, where the material is split to two 4-ft. by 10-ft. single-deck Telsmith Pulsator screens. Perforated plates used on these screens are changed according to the product desired. The material retained on these screens is discharged on a 3-ft. by 12-ft. single-deck Pioneer vibrating screen set at right angles to the other screens. The material retained on it falls on a 24-in. by 68-ft. Chain-Belt inclined belt-conveyor which drops it into a 40-in. Williams hammer-mill. The product of this recrusher is discharged on the main belt-conveyor feeding the screens. The material passing through the three screens drops into a 3-ton hopper from which it is discharged through a chute into railway cars for shipment. This hopper has sufficient capacity to hold the material screened while cars are being moved. The cars are weighed on a Fairbanks track scale before and after loading to determine the net weight.

All the plant equipment is driven through flat belts and line shafts by a 300-hp., 4-cyl. Fairbanks-Morse Diesel engine. This is the latest Model 32 Class E14 machine operating at 300 r.p.m. and it drives a lineshaft through a friction clutch. On this lineshaft are 6 pulleys with flat-belt drives to the various equipment units. Each crusher is driven by an individual belt. Another belt drives a lineshaft from which the main belt-conveyor and the three screens are belt-driven. A fourth belt drives another lineshaft from which the return belt-conveyor and the pan-conveyor are driven. A fifth belt drives a Gardner-Denver air-compressor which supplies air for the batching plant and for quarry drilling. Another belt drives a Fairbanks-Morse reciprocating pump used as a "booster" in the Diesel-engine cooling system. The compressor can be operated by a McCormick-Deering gasoline engine, if drilling is being done while the plant is shut down.



The 56-in. hammer-mill used for primary crushing of the blended material.

The Diesel engine is equipped with a Coppus air filter on its intake and a Purolator is used to clean the lubricating oil. Each cylinder also has a cooling-water temperature indicator and an exhaust-temperature indicator. This engine is about 60 percent. loaded when the plant is operating at capacity and consumes about 20 gal. of fuel oil per hr. This excess power capacity allows for future expansion of the plant's capacity and the contemplated installation of a generator to produce all the electricity needed in the plant. Purchased electricity is now used in the plant only for lights, for controlling the operation of the batching-plant equipment and for the operation of two electric-arc welders.



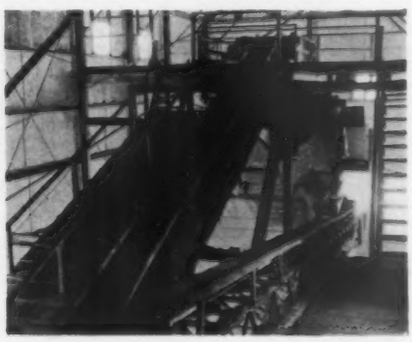
The 4-cyl., 300-hp. Diesel engine which drives all plant equipment by belt.

As an ample supply of cool creek water is available, no cooling system is necessary for the engine-cooling water. A 200-gal. per min. pump supplies water for fire protection to a 40,000-gal. storage tank on a hill above the plant. The "booster" pump already mentioned supplies cooling water from this system to the engine. A new and complete machine-shop and a new warehouse for parts and supplies have also been built since the fire.

The company maintains 11 mi. of track between the plant and the town of Dougherty and has two steam locomotives which haul cars between these points. At Dougherty there is a connection with the Santa Fe Ry.

Most of the company's product is used for highways in Oklahoma and the neighboring states of Texas, New Mexico and Missouri.

The Southern Rock Asphalt Co. is a subsidiary of the Western Paving Co., Oklahoma City, Okla.



At left is the belt conveyor from primary hammer-mill to screens and at right is return belt to recrusher.

This view shows one of the weighing batchers with air-operated gate. Controls are in foreground.

By W. E. TRAUFFER

Installs Diesel-Driven Generators for Dependable and Low-Cost Power

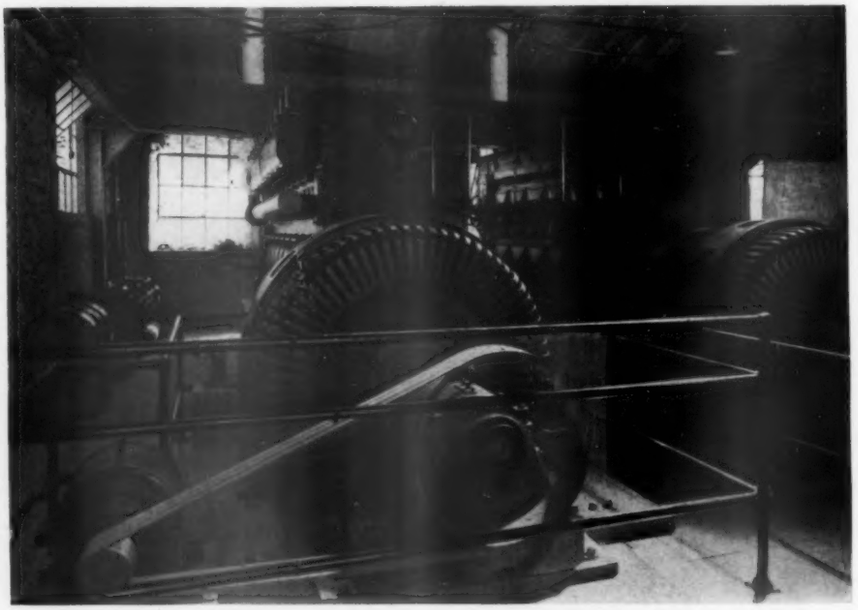
THE high cost of purchased electric power, which received comparatively little attention during the "boom" years preceding the depression, became a subject of paramount importance to nonmetallic-minerals producers when business and prices began to drop. Many producers who were trying to reduce in every possible way the cost of operating their plants—especially those costs which remained at a high level even when their plants were shut down for months at a time—found that purchased-electric-power costs were their most difficult problem. Public-utility companies in most cases made little or no reductions in their rates and this fact, coupled with the demand charges during shut-down periods, resulted in an exorbitant cost for the power actually consumed. Reductions were made in the demand charges for non-operating months but not for months in which a plant was operated for only a few days.

Many producers solved this problem by the installation of Diesel-electric generating plants and a growing number are finding the savings and other benefits obtained in this way sufficient to justify them even during periods of normal business. Independence from outside sources and the ability to use high "peak" loads or shut down entirely without penalties are important advantages of plant-generated power.

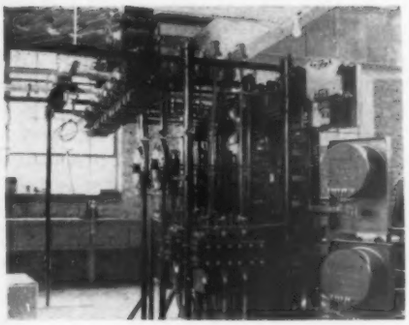
The stone-and-steel power-house with cooling tower at right. The near part of the building is used as a garage.

Power interruptions due to transmission-line trouble are also eliminated.

Along with many other producers the Columbia Quarry Co. was faced with this condition at its crushed-stone plant at Krause, Ill. Since the electrification of this plant 12 years ago 25-cycle power had been obtained from the East St. Louis, Columbia & Waterloo Rwy., which operated the street-railway system in East St. Louis, Ill. In July, 1936, when this street-railway system was replaced by motor 'buses, an even greater problem confronted this company. One alternative was the purchase of 60-cycle current from the Illinois Power & Light Co. at a higher rate than had previously been paid for 25-cycle current. Using this power a 20-min. "peak" load at any time during a month forms the "peak"-load charge for the remainder of that month. It would also have been necessary either to rewind all the motors for 60-cycle current or to install equipment at the plant for converting it to 25-cycle. The latter alternative would have required a rotary converter of sufficient capacity to take care of a "peak" load which might actually never be reached. Either



The two large Diesel engines with their a.-c. generators and exciters. The 8-cyl. engine is at left and the 6-cyl. engine at right.



Electrical equipment behind the main power house switchboard.

method was possible only at prohibitive expense and an excessive loss of plant operating time and the high power cost would still have remained.

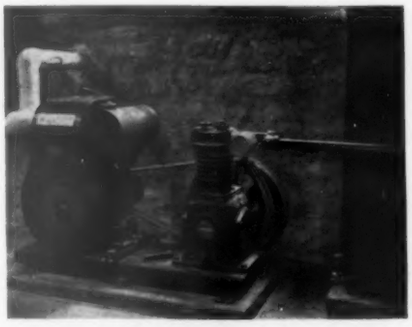
The company's officials, after carefully weighing the advantages and disadvantages of these alternatives, decided in favor of plant power generation. A Diesel-engine generating plant which is one of the most modern and most complete in the crushed-stone industry, was ordered and installed and went into operation on Aug. 26, 1936. During this period of installation 25-cycle power was obtained from the railway company under a special arrangement with the receivers. Full coöperation on the part of the companies supplying and installing this equipment made it possible to install it without shutting down the plant at any time. With this generating plant it is no longer necessary to store excessive quantities of aggregate to get away from winter "peak" loads as the plant can be run with summer economy whenever weather conditions allow.

The attractive building housing the generating equipment and the garage.

With this power-plant it is expected that power will be produced for about 8 mills per kw.-hr. This compares with a cost of 2.6 c. per kw-hr. for purchased power. As there is as yet no way of accurately checking fuel consumption no accurate figures can be given. It is estimated, however, that about 10½ kw.-hr. of electricity is being produced per gallon of Shell Dieseline costing 4.75 c. per gal. delivered. Fuel consumption is guaranteed not to exceed 0.4 lb. per brake-hp.-hr. at full load. The generating plant easily supplies sufficient current to operate all the plant and quarry equipment, a total of about 1,265 connected hp. of 480-v. motors.

An existing steel-and-stone garage building was enlarged to form the power-house and compressor-house. This building now presents a very neat and attractive appearance. Rough dimension stone of the type popular for house building was used for the walls up to the eaves. On this wall also rest the rails for an overhead traveling crane which is equipped with a chain hoist and serves the engines and other equipment. The concrete floors required 121 cu. yd. of concrete. The foundations for the equipment were poured to a depth of over 8 ft. to solid rock. One large compressor supplying air for all the operations was moved into one end of the building. All this work was done by the company's forces.

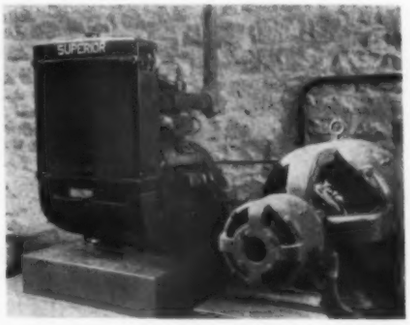
The two main power-generating units consist of National Supply Co. of Dela-



The gasoline-engine-driven compressor which supplies air for starting engines.

ware Superior Type MS Diesel engines driving direct-connected Allis-Chalmers 480-v. alternators. These engines are cold-starting, mechanical-injection 4-cycle machines with 12½-in. bore and 15-in. stroke and operate at 375 r.p.m. The 8-cyl. engine is rated at 525 hp. and the 6-cyl. engine at 400 hp. but both have emergency overload capacities considerably in excess of these ratings. These engines are fully inclosed with side plates and hoods and present a very attractive appearance.

These engines are started by compressed air supplied at 250 lb. pressure to all the cylinders. The air is supplied to a separate receiving tank for each engine by a 2-stage Curtis Pneumatic Machinery Co. compressor driven by a 1-cyl. Wisconsin gasoline engine through a Gates V-belt. Each engine is equipped with an American Reed Type SCF-2 intake air-filter with weather louvres which are located outside the power-house on the side away from the plant. Shell S.A.E. 40 lubricating oil is used, a Goulds Hydroil centrifuge clarifying the oil for both engines. A motor-driven synchronizing device on each engine is controlled from the main switchboard. Each engine also has an Alnor selective exhaust-temperature indicator, which instantaneously gives the temperature at any cylinder, and a cooling-water temperature gage. The exhaust temperature varies with the load on the engine but averages about 700 deg. F.,



The small Diesel-engine generator which supplies lighting current.

while the water temperature varies between 110 and 120 deg. F. An automatic alarm system sounds a Klaxon horn when the lubricating-oil pressure drops too low and when the cooling-water temperature rises too high.

Shell Dieseline fuel oil of 30 specific gravity is purchased in car-load lots and is stored in a 15,070-gal. steel tank near the plant. A transfer pump feeds the oil to a 550-gal. surge tank from which it passes through a filter to the high-pressure engine-feed pump.

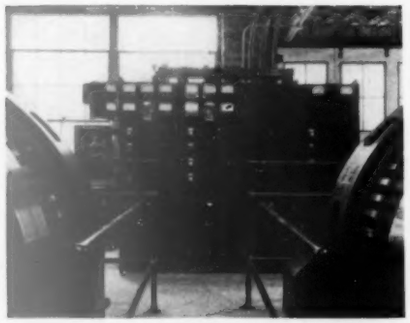
The cooling water for the engine is circulated over an outdoor cooling tower made by the Cooling Tower Co. This has a steel collecting base and a built-in atmospheric-type heat exchanger. Its capacity is 1,500 gal. Raw or make-up water is taken from a pond near the plant for the cooling-water supply and is passed through a Scaife Type OS-15 household-type water softener before going into the cooling system. A 4-in.

The air-intake filters for the two large Diesel engines.

Deming pump rated at 450-475 gal. per min. supplies the soft water to the engine jackets and a similar pump puts water through the tower to cool the coils. Each of these pumps is driven by a 10-hp. electric motor.

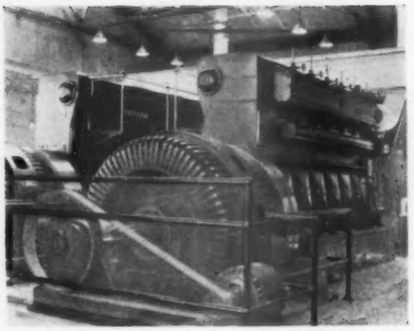
The Allis-Chalmers generator direct-connected to the 8-cyl. Diesel engine is a 438-kv.-a., 350-kw., 527-amp., 3-phase, .80-power factor, 25-cycle, revolving-field, engine-type alternator with damper windings and a field rheostat. The alternator connected to the 6-cyl. Diesel engine is the same in every detail except that it is rated at 333 kv.-a., 400 amp. and 266 kw. Both alternators generate 480-v. current and operate at 375 r.p.m. Each engine has an Allis-Chalmers exciter which is driven through Texropes from the main shaft at 1,750 r.p.m. The exciter for the 8-cyl. engine alternator is rated at 10 kw., 125 v., 80 amp., and the other at 7½ kw., 60 amp., 125 v. Both units are of the shunt-wound type.

These two large generating units can be used separately or together, depending on the amount of equipment in operation, and when in operation they also supply lighting current. A 3-phase transformer reduces the 480-v. current to 115 v. for lights. Since this equipment was installed a small generating set has been added to supply lighting current for the plant and for the employees' houses when the large units are not running. A 22½-hp. Superior Model IA2 Diesel engine, made by the Philadelphia plant of the National Supply Co. of Delaware, drives through a V-belt a Chandeysson 3-phase, 25-cycle, 480-v., 22.5-amp. alternator at 750 r.p.m. On the generator shaft is a Chandeysson



The 4-panel switchboard and instruments controlling the generation of power.

32-v., 30-amp. d.-c. generator for excitation. The 480-v. current from this alternator can be reduced to 125-v. lighting current through the transformers described above. If desired, this generator is capable of supplying the current for 10 hp. of 480-v. motors, sufficient to operate the machine- and repair-shop equipment and at the same time supply enough light to make repairs in the plant. This engine has an electric start-



The two large Diesel engines with their generators and exciters in the foreground.

ing motor operated from two Willard storage batteries.

All this equipment is controlled from an Allis-Chalmers switchboard having three generator panels, a feeder panel and two swinging brackets with automatic voltage regulators. The two Allis-Chalmers Brown-Boveri voltage regulators automatically keep the output of the two large generators at 480 v. When the entire plant is in operation a power factor of .80 is maintained and an indicator tells when the three generators are in synchronism, so that the lighting load can be switched from one generator to either of the others. Other instruments on this board include a.-c. and d.-c. voltmeters and ammeters and polyphase watt-hour meters for each of the generating sets, trip coils, switches, and a circuit-breaker through which current is sent to the plant. The electrical equipment was installed by the Albo Electric Co., St. Louis, Mo., which 13 years ago electrified the entire plant when it was built to replace an older plant destroyed by fire.

Steel Gravel Dredge Is Salvaged After Sinking

A steel dredge, valued at $35,000 with equipment and owned by the Western Indiana Gravel Co., Lafayette, Ind., went to the bottom recently at the company's operations at Winona Lake, Ind. Workmen are now busy salvaging it.

NEW YANGTZE RIVER CEMENT PLANT IN CHINA TO START OPERATING THIS YEAR

A new cement plant of 1,000 bbl. daily capacity is almost completed on the bank of the Yangtze River opposite Chungking, Szechwan, according to the U. S. Bureau of Mines. Much of the machinery, imported from Denmark, is already installed. Due to the unusually early low-water season on the Yangtze, all the equipment could not be transported from Shanghai to Chungking in 1936, but the plant should be ready to start about May or June of this year. The West China Development Corp., a Chinese company with foreign-trained engineers, is in charge of construction.

The new works is well-situated regarding sources of raw materials. Limestone will be obtained from along the banks of the Kialing River in the Pehpei district about 30 miles from the plant, which is about three miles above the mouth where the Kialing River joins the Yangtze, and can be transported by junks without costly land hauling. If that area fails through traffic disruption on the Kialing River or labor difficulties there, suitable limestone can be obtained at places on the Yangtze above Chungking and transported by boat to the plant. For fuel, coal of suitable quality, is available from Chungking mines at as low as Chinese $6 (U. S. $1.80) per ton, delivered at the plant.

The cost of production is expected to be very reasonable, and the new plant is the only one of its kind in Szechwan and so should be able to compete against the non-Szechwan cement plants, the nearest of which, at present, is in Hupeh, near Hankow, and for whose products the price quotations must include the cost of high freight charges on the Upper Yangtze for transportation to Chungking. Therefore, the new enterprise at Chungking, which is understood to have strong financial backing, is expected to realize good profits.

The new enterprise hopes to be able to supply all the needs of the new Chungking-Chengtu Ry., the building of which will begin on a large scale in the spring and which will require a large quantity of cement for construction. Moreover, an ever-increasing market for cement in Szechwan is being created by the city-modernization movement that is spreading throughout this province of 48,000,000 people in an area of 155,000 sq. mi. As new motor roads are cut through the cities, it is necessary to construct new buildings to line the widened streets. New buildings of three to five stories have been erected for mile after mile along the new streets of Chungking and to a smaller extent in many other cities. Numerous new buildings will be entirely of concrete; in others, just the ground floor will have cement in its construction. New sidewalks, sometimes concrete-paved roads, are being laid in the cities at an increasing rate. Therefore, the company is hopeful that when the new plant is in operation it will have no difficulty in finding a market for all the cement it can manufacture.

By JOHN W. O'LEARY
President, Machinery & Allied Products Institute

DEPRECIATION-RESERVE POLICIES

Because of the interest which followed publication of an article on depreciation by Wm. E. Hilliard in the October, 1936 issue, PIT AND QUARRY is pleased to present another message on the subject from a recognized leader in the industrial world.—Editor.

FREQUENT review of depreciation-reserve policies of a corporation is made necessary by many changing factors, the principal one of which is legislation. Laws enacted in 1936 have a far-reaching effect upon reserves, dividends, taxes, costing and commodity pricing. Another important factor is the constant development of higher standards for the product manufactured which place greater demands upon plant and equipment and greatly affect obsolescence and depreciation rates. American industrial executives face the necessary of reëxamining the status of their capital accounts, and of developing accurate, sound and adequate depreciation reserve policies. The principal new factor is the Revenue Act of 1936, which includes in addition to normal Federal corporation income tax an undistributed-surplus tax ranging from 7 to 27 per cent. of the undistributed book income.

Formerly if a taxpayer failed to charge adequately for depreciation and obsolescence, his resulting maximum loss was the normal income tax on the amount by which such deduction for depreciation was inadequate. If all apparent income was then disbursed in dividends, capital impairment would have occurred, but corporations usually retained a considerable portion of apparent income in surplus and capital impairment was avoided.

Under the 1936 Revenue Act circumstances are dangerously altered. Not only is there the loss of normal income tax upon the amount by which depreciation deduction was inadequate, but in addition there is a superimposed penalty—the corporation undistributed-surplus tax of 7 to 27 per cent.—upon such amount of apparent or book income. If excessive dividend disbursements are made to obtain a lower undistributed-surplus tax rate, serious capital impairment occurs. In the event of a subsequent disallowance of depreciation deductions a further book profit results, and a dividend-paid credit can not be retroactively applied against it.

Proof to the Bureau of Internal Revenue of justification of depreciation rates is required by Treasury Department Order 4,422, and Mimeo 4,170 as revised July 10, 1936. These orders carry out the present Federal tax policy of increasing revenue by decreasing the tax-exempt depreciation deductions. Adequate ledgers and budgetary control of depreciation accounts are rare, and as a result of the inability of the taxpayer to justify the rates charged numerous incidents of forced decreases in depreciation are reported. If the facts were known and recorded there would be no justification or opportunity for the arbitrary dictation of rates by government. Management is best informed on the value-in-use of its assets and is best fitted to establish the required charges for depreciation reserves. Properly supported and recorded, the established charges become an element in determining costs, taxes and value, fully acceptable to taxing bodies.

The Robinson-Patman Price Discrimination Act prohibits discrimination in price except where based solely upon differences in the cost of manufacture, sale or delivery, and the Vinson Naval Appropriations Act requires that profits above cost shall not exceed 10 per cent. on navy contracts.

Depreciation is the one element of cost paid ahead of use. There is a failure in many instances to recognize depreciation as an element of cost as important as labor, material and overhead burdens. Depreciation is the one element of cost not generally fully known and recorded. The provisions of such acts as these emphasize the importance of a knowledge of costs—a knowledge of the productive value of capital assets as they change with technological advancement and with wear from use.

The prime objective of the Committee on Reserves for Rehabilitation of the institute in its study of practices and requirements has been to formulate a depreciation-reserve policy acceptable to management, finance and legislative bodies, cutting through the complexities which have gradually developed since the enactment of the first corporate-income tax law. This policy, expressed in these three points, is recommended for adoption by industrial management to govern depreciation reserves.

1. *Purpose.*—Since the investment of capital in an asset is in reality prepaid depreciation expense, the principal purposes of establishing depreciation reserves through current charges to income are:

(a) To maintain capital investment intact.

(b) To recover the cost from the selling price of the product of the asset during its useful life.

2. *Method of Accumulation of Depreciation Reserves.*—Nationally standard rates or methods are not practical. The prediction of the probable life and productiveness of an asset is essentially a management problem requiring, in each individual case:

First, consideration at the time of acquisition of the asset of—

(a) Wear because of use.

(b) Obsolescence of asset.

(c) Obsolescence of product.

(d) The rate and method of recovery of the cost of the asset.

Second, redetermination of the useful economic life of the asset at periodic intervals to reconcile its predicted life with its actual life in practice.

3. *Use of Depreciation-Reserve Funds.*—Depreciation reserves accumulated from the selling price of a product of an asset should be subjected to the same budgetary control and accounting record as other elements of production cost.

The executive officer responsible for the financial policies of the company should authorize the installation of a "plant ledger," in which would be compiled the necessary data concerning

each piece of fixed or major equipment, together with auxiliary equipment such as shafting, belts, pulleys, etc., by group units, to show:

1. Description of the unit.

2. Date installed.

3. Cost—

(a) Of unit.
(b) Of installing it (estimated, if necessary).

4. Plant location.

5. Type of work performed—

(a) At present.
(b) Any change-over from original purpose.

6. Report of the superintendent or foreman on the present use of the unit and its present condition.

7. Opinion of the superintendent and foreman as to its further useful life.

8. Other pertinent data which would fully inform the management of the character of the equipment and its condition from an operating standpoint with regard to the product now produced.

There should be an assignment of values to these units of equipment which, in total, will agree with either the gross value less the accumulated depreciation reserves as shown on the financial books, or the net value of the fixed assets carried on the financial books. It probably will be necessary in any case to apportion, somewhat arbitrarily, these dollar values.

The set-up of the initial information for new equipment purchased should provide historical data from which to determine in the future the condition and value-in-use of this equipment.

In most cases depreciation deductions of the past, as accumulated in reserves, are probably not possible of identification in corresponding asset accounts or as capital losses. The replacement of equipment costing in excess of the current provision for depreciation, therefore, will probably be necessary out of new capital funds as the present tax laws, which penalize undistributed earnings, will impose possibly undue hardships on the retention of earnings in the business.

In the future the accounting records should be sufficient in scope to keep the executive informed as to whether the reserves for depreciation are: (1) set aside in an investment fund of securities, (2) being used to acquire additional equipment, (3) borrowed for working capital to avoid bank loans, or (4) really eating up capital.

When it is necessary to convert equipment to meet changes in manufacturing procedure, complete records of this change-over should be reflected in the plant ledger.

If a revision of the value of the equipment for future use is necessary, the adjustment of loss, if any, should be made, and proper adjustment should also be provided with respect to depreciation allowances for the future.

The policies proposed do not prohibit the establishment of rates or methods of accumulation for recovery, but do require periodic review of the accuracy of any rates or methods used. Depreciation is not fixed, but is as subject to change as any factor in any business. Technological progress is shortening the time during which assets stay modern. Therefore, depreciation-reserve practice and policy require periodic review, and rates applied do not merit the permanence that is frequently and incorrectly ascribed to them.

The recommended depreciation-reserve policy does not advocate higher or lower rates; rather it aims toward the establishment of factual rates supported by records.

Unsound depreciation-reserve policies resulting from a lack of knowledge of true costs are reflected in:

1. Reduction of the ability to modernize.

2. Depletion of capital.

3. Sales below cost.

4. Financial statements reflecting unsound values.

5. Doubtful statistical and cost data.

6. Inaccurate guidance for financial, managerial, legislative and taxing bodies.

The practice of regularly replacing equipment is a desirable one. The advantage of using up-to-date equipment with costs at the minimum is enjoyed, and the necessity for large special appropriations for replacements, often difficult to finance, is avoided.

Three common errors found in the computation and utilization of depreciation reserves warrant especial mention:

First—the most serious error—the arbitrary setting of annual depreciation charges to effect more favorable balance sheets.

Second—the most prevalent error—the adherence to book values regardless of economic values. The book value of an asset is by no means necessarily the real value. Replacement studies must not be influenced by book values.

Third—the failure to direct recovered depreciation reserves into rehabilitation channels. To use depreciation recoveries for other purposes is like an individual borrowing on a life-insurance policy to pay current living expenses.

Tentative Standards for Flow of Concrete

Committee C-9 on *Concrete and Concrete Aggregates* of the American Society for Testing Materials during 1936 completed three new tentative standards covering test for flow of concrete by use of the flow table (C-124), laboratory method of making flexure tests of concrete using a simple beam with third-point loading (C-78), and method of test for coal and lignite in sand (C-123). Five existing tentative specifications were advanced to standard and other recommendations involving specifications and tests in the charge of the committee were approved.

By joint action of Committees C-9 and D-4 on *Road and Paving Materials* two new tentative test methods for specific gravity and absorption of coarse aggregate (C-127) and of fine aggregate (C-128) were developed. These methods are in effect revisions and consolidations of four other standards. A method for determining organic matter in fine aggregates and specification requirements for light-weight aggregates are expected to be completed during the coming year and Committee C-9 anticipates submitting for approval the test method for abrasion of aggregate using the Los Angeles rattler.

Included in the new projects before the committee is a further study of methods for the determination of specific gravity of aggregates.

SITS; WINS VACATION

Eighteen - year - old Miss Fern Rudolph started a sit-down strike of her own on March 1 in the office of the Concho Sand & Gravel Co., Oklahoma City, where she worked as a stenographer, refusing to budge until she got a $10 rise. She compromised with President A. E. Perry, however, who refused the rise, but granted her a vacation. Press reports failed to state whether the vacation was permanent or temporary.

Erects New Plant for Making Mineral Wool

The General Insulation & Mfg. Co., Alexandria, Ind., has completed the construction of a new two-cupola mineral wool plant at Dover, N. J. Robert Kilgore, formerly connected with the Alexandria plant, will manage the new unit.

MEN of the INDUSTRY

RALPH E. McLEAN

A descendent of two families who were prominently identified with the founding and developing of East St. Louis, Ill., across the Mississippi River from St. Louis, Mr. McLean has been in the crushed-stone industry since the beginning of the present century. As president of the East St. Louis Stone Co. he has been actively engaged in the operation and management of the firm through the 35 years of its existence with the exception of a short period when it was operated under lease by another concern. The deposit upon which the quarry is located is rich and extensive and records show that material was being quarried from it as far back as 1854.

Personal Mention

L. C. NEWLANDS, formerly general manager and vice-president, has been elected president of the Oregon Portland Cement Co., Portland, Ore. H. L. KNAPPENBERGER, formerly secretary-treasurer, has been made vice-president and general manager. FRANK E. McCASLIN, formerly asst. secretary, has been appointed secretary-treasurer.

J. L. NICHOLSON, JR., general manager of the Cerulean Stone Co., Cadiz, Ky., has announced that his company has installed a new lime pulverizer and other equipment. The new machinery will increase the daily production of the company from 150 tons to over 500 tons.

RICHARD G. UHLIG, general manager of the Missouri Portland Cement Co., St. Louis, Mo., has acquired a home site in suburban St. Louis, where he plans to erect a residence on the plot to be completed some time early in the summer.

A. W. ROHLWING, formerly field engineer in Indiana, has been named district engineer at Indianapolis by the Portland Cement Assn., succeeding H. J. McDargh who was recently transferred to Atlanta, Ga., as regional manager. Other appointments include A. F. UNCKRICH as district engineer at Columbus, O., and A. M. DAVIS as district engineer at Lansing, Mich.

J. F. KEEFNER and Mrs. Keefner of the Keefner Ready Mixed Concrete Co., Des Moines, Ia., have gone to California where they will sojourn for about two months.

WILLIAM B. MAYO, formerly chief engineer of the Ford Motor Co. and now president of the Chicago, Duluth & Georgian Bay Transit Co., was elected chairman of the board of the Huron River Silica Co., Detroit, Mich., at the annual stockholders' meeting held recently. J. WALTER DRAKE, assistant secretary of commerce during Pres. Hoover's administration and organizer of the Hupp Motor Co., was named president. This is Mr. Mayo's second venture in the glass industry, the first being his invention of the continuous process for the manufacture of plate glass now used by the Ford Motor Co. and others.

M. M. FROST has been named assistant director of sales by the Florida Portland Cement Co., Tampa, Fla. He was formerly assistant sales manager at Jacksonville.

PAUL THOMAS has succeeded W. B. Richards as superintendent of the River Junction plant of the Florida Gravel Co.

T. A. OBERHELLMANN has been placed in charge of a new sales office recently opened at 205 W. Wacker Drive, Chicago, by the Gruendler Crusher & Pulverizer Co. The office will serve the north central area.

GRANT B. SHIPLEY, of Pittsburgh, Pa., has purchased the Foxburg Silica Co. plant and business and has organized a new company with a Pennsylvania charter, to be known as the Century Silica Co. The Century Silica Co. plans to reconstruct the old Foxburg plant and have it ready for operation within the next few months.

T. R. AGG, dean of engineering, Iowa State College, Ames, Ia., was given the George H. Bartlett Award for achievement in highway work at the recent meeting of the Highway Research Board. The basis for the award was Dean Agg's research work in highway engineering and economics for the Iowa Engineering Experiment Station. The Bartlett Award is given by the American Assn. of State Highway Officials, the American Road Builders Assn., and the Highway Research Board.

JOHN L. A. GALSTER has been made president and treasurer of the Petoskey Portland Cement Co. and the Petoskey Transportation Co., of Petoskey, Mich. He succeeds J. B. John, president for many years, who remains as a member of the board of directors. GEORGE W. JOHN, son of the retiring president, succeeds Mr. Galster as general manager.

EDWARD BALF, ready-mixed-concrete producer of Hartford, Conn., has added three 3-cu. yd. Rex mixer trucks to his fleet.

ARTHUR E. GAYNOR has been named manager of the New York branch of John A. Roebling's Sons Co., succeeding the late W. P. Bowman.

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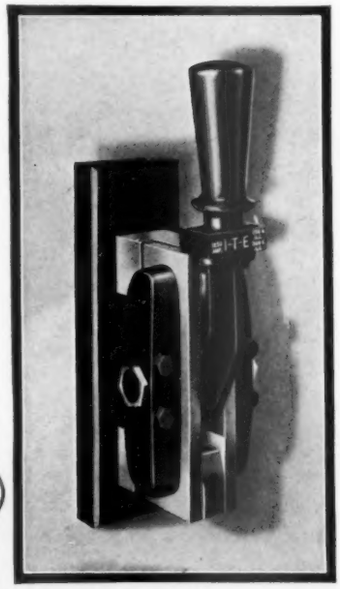

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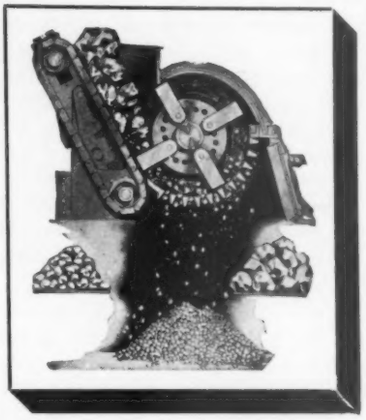

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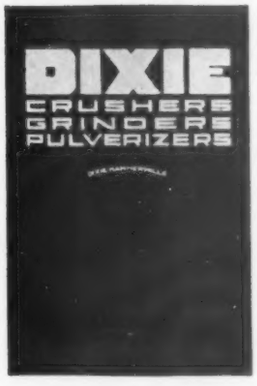

DIXIE MACHINERY MFG. COMPANY
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D. L. CARPENTER has resigned as president of the Beaver Portland Cement Co. in order to devote his full time to the affairs of the Ross Island Sand & Gravel Co., Portland, Ore., which he also heads.

DR. HELMUTH H. SCHRENK has been appointed chief chemist of the health division of the U. S. Bureau of Mines. Dr. Schrenk succeeds William P. Yant, resigned, and will have his headquarters at the Pittsburgh Experiment Station.

GEORGE A. MORRISON, for the past ten years superintendent of mines for the West Penn Cement Co., West Winfield, Pa., has resigned to become general manager of the Orogrande-Frisco Gold Mines, Inc., at Orogrande, Ida.

R. B. RENNER, who has been with the Jeffrey Mfg. Co., for the last 30 years as mechanical engineer, was recently made chairman of the executive committee of the materials-handling division of the American Society of Mechanical Engineers.

GEORGE E. TREMBLY, regional highway engineer, midwestern states, Portland Cement Assn., died Feb. 13.

GEORGE BREW, 68, president of the Waukesha Washed Sand & Gravel Co., Milwaukee, Wis., died at his home in the Astor Hotel in Milwaukee after an illness of three months. He formed the company which he headed about 20 years ago.

WM. P. BOWMAN, New York branch manager of John A. Roebling's Sons Co., died on Jan. 22.

O. L. SHUMARD, formerly superintendent of the Silica, O., plant of the Medusa Portland Cement Co., died recently at his home in Kansas after a brief illness.

ROBT. W. GOTSHALL, general sales representative for the Caterpillar Tractor Co., died in St. Francis Hospital, Peoria, Ill., on Feb. 11.

RAY BONSIB, 53, Indiana University track star of 1904 and 1905 was killed in an automobile accident near Muscatine, Ia., recently. He was employed as a salesman by the Hoadley Stone Co., Bloomington, Ind.

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Foreign Developments

How Sulphatic Compounds Affect Portland Cement

Tonindustrie-Zeitung in its issue of October 29, 1936 (60:1076-1077), reviews editorially two recently published investigations of Dr. G. Mussgnug concerning the action and effect of sulphatic compounds in cement (the articles in question are *The SO_3 Content in Portland Cement Clinker, Zement* 1936, Nos. 15 and 16, and *Disturbances in the Set of Cement,* Mitt. Forsch-Inst. G. H. H.-Konzern, Vol. 4, No. 7, Oberhausen, July, 1936). From a detailed review of these investigations the editors note that as the most important results of Mussgnug's investigations it should be observed that the temperature of burning and the kiln atmosphere strongly affect the SO_3 content; that the SO_3 content in the clinker can in many cases entirely and in other cases partially displace the gypsum; that it is possible to cure "quick-setters" by the addition of sulphur-bearing materials to the raw mix; and finally that natural gypsum ($CaSO_4.2H_2O$) is the most reliable admixture for regulation of the setting time. Since partially dehydrated gypsum in considerable quantities can lead to the production of "quick-setters," it is desirable, when this occurs on account of high temperature in the grinding mills, to reduce the proportion of gypsum, unless the trouble can be eliminated by cooling the mill so that the double hydrate can be preserved.

The *Disturbances in the Set of Cement* article is also reviewed at length in *Zement* for Dec. 10, 1936 (25:-866-868).

Studies on Properties of High-Magnesia Cements

Magnesia is an undesired constituent of cement because when present in appreciable quantities it causes "magnesia unsoundness"; cement of apparent soundness begins after sometimes months or years to swell and crack. A small percentage of magnesia does not affect the soundness or strength; in the standard specifications of most countries an upper limit of 5 per cent. MgO is tolerated for absolutely-sound cement. Nevertheless various processes have been presented in recent years for the production of sound cements of higher magnesia content. An examination of the literature reveals that the opinions of different investigators on the constitution of magnesia in Portland cement are at variance and contradictory, and based on different conceptions of the theoretical bases.

In the investigations reported here the concentrations in connection with which MgO could combine with the acid constituents were ascertained from the equilibrium relations between the components CaO, MgO, Al_2O_3, Fe_2O_3 and SiO_2. Magnesia is combined when the lime content is not sufficient to satiate up to a certain degree SiO_2, Al_2O_3 and Fe_2O_3. These limits are:

1. In combination with SiO_2
2. In combination with Al_2O_3 (or Fe_2O_3)
3. In combination with Fe_2O_3 (or Al_2O_3)
4. In combination with $Al_2O_3 > Fe_2O_3$
5. In combination with $Al_2O_3 < FeO$

$2CaO.SiO_2$
$CaO.Al_2O_3$
$2CaO.Fe_2O_3$
$4CaO.Al_2O_3.Fe_2O_3 + CaO.Al_2O_3$
$4CaO.Al_2O_3.Fe_2O_3 + 2CaO.Fe_2O_3$

The formation of tricalcium silicate, the most important clinker mineral, according to the equation $2CaO.SiO_2 + CaO = 3CaO.SiO_2$ can only take place when the alumina and iron oxide are completely satiated with lime. From this it follows that in the presence of tricalcium silicate magnesia can occur only in the free state, as periclase.

MgO in combined form along with tricalcium silicate is possible only as mixed crystals with $4CaO.Al_2O_3.Fe_2O_3$, but $4CaO.Al_2O_3.Fe_2O_3$ can take up only 2 per cent. of its weight in MgO. Computed to the total clinker, 0.2 to 0.3 per cent. MgO is so combined. The MgO embedded in $4CaO.Al_2O_3.Fe_2O_3$ causes the green color of the clinker.

The series of lime combinations in Portland cement was derived exactly as the basis for the computation of the mineral composition of clinker. The series is: $2CaO.SiO_2$, $4CaO.Al_2O_3.Fe_2O_3$, $3CaO.Al_2O_3$ or $2CaO.SiO_2.Fe_2O_3$, $3CaO.SiO_2$; the MgO remains uncombined. The composition of two magnesia clinkers was computed on this basis. The second clinker was distinguished by the fact that on the basis of the chemical analysis the satiation condi-

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ASK FOR CATALOG 36

tions enumerated above are not fulfilled and in the mineral composition there should be free magnesia and spinell, $MgO.(Al, Fe)_2O_3$, but no tricalcium silicate. The result of the calculation was verified by chemical and quantitative Roentgenographic analysis.

The reactivity of MgO in combination with SiO_2, as occurs in blast-furnace slag with lime, was investigated. It is shown that the reaction at 1,250 deg. F. in the solid phase already takes place so rapidly that complete conversion in clinker burning can be assumed.

Further investigations concerned the course of mineral formation of magnesia-bearing clinker from the oxide components. MgO can take part in the course of the reactions—$3CaO.MgO.2SiO_2$ and $MgO.(Al, Fe)_2O_3$ are demonstrated, but the MgO-bearing intermediate combinations occur even at high magnesia contents only as by-product, so that at normal concentration they play no part.

The requirements of the Balthasar process for the production of high-magnesia-bearing cements—the addition of iron oxide, increasing of the burning temperature and prolongation of the sintering time—are well adapted to convert greater amounts of MgO than the 5 per cent. tolerated in the standard specifications into a less reactive form by embedding in the melt or increasing the particle size. There exists the possibility, however, that the reactivity with water is only a little diminshed, so that cements of this sort must be observed over a long period of time before their soundness can be judged with certainty. —H. E. Schwiete and H. zur Strassen in *Zement* 25: 843-846, 861-865, 879-882, Dec. 3, 10 and 17, 1936.

Photoëlectric Cell in Automatic Kiln Control

The conditions necessary for satisfactory operation of a rotary kiln are uniform fuel and air feed, adjustment of the kiln speed to the quantity of material, and constant draft. A photoëlectric cell, placed at the head of the kiln so as to pick up the rays from the material at the point where the temperature begins to reach the point of vitrification, is very effective in controlling and changing automatically the speed of the kiln and the feed of pulverized coal or oil and air, and these operations present no difficult problems. The regulation of the draft presents more difficulties. An apparatus for regulating and changing the draft automatically is described. —*Revue des Materiaux de Construction et de Travaux Publics,* No. 328, January, 1937, p. 21.

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Traffic News Digest

Legislation

Fourth Section Amendment.—While perhaps not of greatest importance the one bill in the legislative hopper that has attracted the most attention among traffic men is House Bill No. 1,668, introduced by Representative Pettengill, proposing to eliminate the long-and-short-haul clause and the so-called equidistant clause from the fourth section of the Interstate Commerce Act. Following the events already reported (P. & Q., February, 1937, p. 90) other proponents of the bill and the opponents were heard, following which certain proponents of the bill offered rebuttal testimony bringing the hearing to a close on February 17. All parties seemed to be in favor of eliminating the equidistant clause or at last no active opposition to the elimination of that clause was heard, the real contention developing over the long-and-short-haul clause.

Those in favor of eliminating the long-and-short-haul provision include the National Industrial Traffic League, a shippers' organization, railroad labor organizations and the Assn. of American Railroads. Opposed to the bill are the intercoastal steamship lines, steamship labor organizations, motor carriers, certain shippers who feel that they might be adversely affected, and members of the Interstate Commerce Commission.

Commissioner Eastman, appearing before the committee, pointed out that this provision has been a part of the law for fifty years; that it was enacted to correct an abuse which was widespread and that a law with such a history ought not lightly to be repealed. He pointed out further that the same results could be obtained even with this provision repealed, if the commission could still construe Sec. 3 to prohibit the thing that is now prohibited by Sec. 4. He contended that the agitation for this bill was due to the fact that the railroads wanted to meet the competition of intercoastal water carriers without reducing the rates to intermediate points and that the amount of traffic which would go to the railroads if they lowered their rates to meet water competition would not add appreciably to the earnings of the railroads and that relief from Sec. 4 would create no new traffic but merely divert traffic from one carrier to another or from one part of the country to another and that it could not affect the prosperity of the country as a whole. The claim that failure to grant liberal relief has prostrated manufacturing in the interior of the country at the expense of the seaboard is not supported by census figures. On the contrary, they show the reverse. He stated further that water carriers should be brought under the same degree of regulation as is now provided in the case of the railroads and the motor carriers not only for the good of the latter, but for the good of the water carriers themselves.

The case for the proponents of the bill was summarized by J. P. Haynes, chairman of the special committee on the fourth section of the National Industrial Traffic League, when he appeared with a rebuttal statement on February 16. He argued that the elimination of the long-and-short-haul clause would not remove any protection to either shippers, receivers or competing transportation agencies that is not afforded by other sections of the act in so far as the reasonable non-discriminatory, non-preferential and non-prejudicial nature of rates is concerned; that by reason of this clause the railroads are prevented from or seriously delayed in effecting adjustments necessary to allow the free flow of commerce; that it places an arbitrary, unreasonable and wholly unjustified restriction upon the railway carriers by requiring them to obtain specific fourth-section relief and because, as administered by the Interstate Commerce Commission, it serves no public need, but, on the contrary, results in tremendous waste and unnecessary expense which in the final analysis must be assumed by the shipping public.

Congressmen opposed to the amendment have organized, with Representative Hill of Washington as chairman and Representative O'Connell as secretary of the group. A steering committee appointed to oppose the bill includes Representatives Pierce, chairman; Rankin of Mississippi, Calkin of New York, Clark of Idaho, O'Connell of Montana, Luckey of Nebraska, and Hope of Kansas. This committee has issued a lengthy statement in which appears the following: "It should be made clear that this bill appears to be the answer of the Wall Street owner of railway stocks and bonds to the development of waterways and motor trucking. It has apparently resulted from a determination to prevent the benefits of progress in transportation from accruing to producers who are now feeling some relief on account of the competition of trucks and waterways." The bill has been introduced into the Senate by Senator Lonergan of Connecticut as Senate Bill No. 1,356. The bill passed the House in the last Congress but was never reported out of committee in the Senate.

Recent I. C. C. Decisions

Cement.—In a thirteenth-section proceeding the commission prescribed intrastate rates on cement between Marquette, Mo., and points in Missouri based on Scale III in western cement rates 69 I. C. C. 644, 658, 659. The prior findings, as reported in 176 I. C. C. 671, have been modified to enable the Missouri-Pacific, which has a circuitous route from Marquette to Sikeston, Mo., to meet the rate applying over the direct route and to maintain rates no higher at intermediate points in conformity with the provisions of the Missouri state law. —I. C. C. Docket No. 21,492, Dewey Portland Cement Co. *v.* A. & E. *et al.;* No. 21,500, Same *v.* A. & W. *et al.;* and No. 21,635, Same *v.* C. B. & Q. *et al.*

On further hearing the commission has affirmed the finding in prior report 210 I. C. C. 293 that the carriers compensation under its line-haul rates did not govern service performed beyond the interchange tracks and that payment of an allowance for terminal service to the Louisville Cement Co. was unlawful.—I. C. C. Ex Parte No. 104 Part II.

Crushed Stone, Sand and Gravel.—In the 7th supplemental report the commission has modified prior findings to allow carriers to establish rates on crushed stone, sand, gravel and slag of 40, 50, and 60c. for 1-, 2- and 3-line hauls within the Chicago switching district and rates of 45 and 65c. for single and joint hauls from Joliet, Ill., to points in the Chicago switching district, such rates to be in effect for a period of 18 months. This is in response to the petitioners' reports for authority to publish rates of 35, 45, and 55c. for hauls within the district and rates of 40 and 60c. for shipment from Joliet, Coleman, Munger, and other points to Chicago. The commission found that the rates proposed by the carriers

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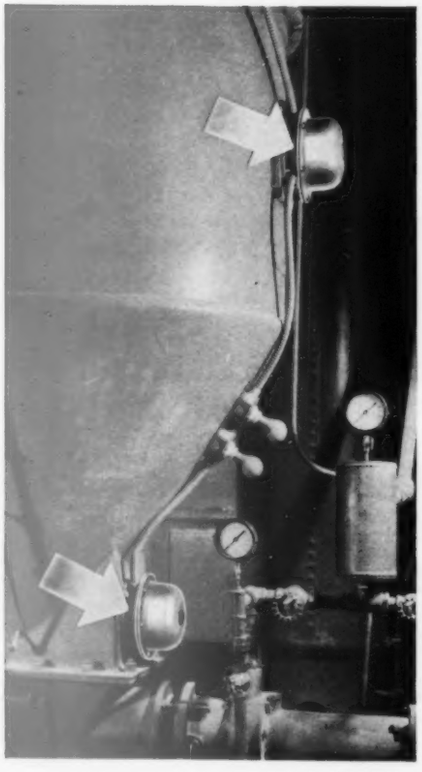

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were lower than necessary to meet motor-truck competition.—I. C. C. Docket No. 19,610, switching rates in Chicago switching district and related cases.

Sand.—In a report embracing a large number of sand cases the commission has prescribed rates on sand in open-top cars from Michigan City, Ind., to Streator, Pontiac and Gibson City, Ill., of $1.13; to Decatur and Springfield, $1.39; to Taylorville, Jacksonville, Fitchfield, and Edwardsville, $1.51; to East St. Louis, $1.64; to Quincy, $1.17; and to Cairo, $2.39. To St. Louis, Mo., the prescribed rate is $1.89 and to Hannibal and Belleville, Mo., $2.14. From Polk and Utica, Pa., to destinations in Pennsylvania and New York for distances of 200 mi. and less maximum rates, made by use of the West Penn scale reported in 104 I. C. C. 717 based on single-line distances, have been prescribed. In some of these cases reparation has been awarded. A statement of all the cases included in the report will be furnished on request.

Sand and Gravel.—Finding the rate on sand and gravel from Hawarden, Ia., to Barker, S. Dak., on shipments moving between July 6 and September 4, 1934, unreasonable to the extent that it exceeded 70c. a net ton, reparation amounting to $32.46 with interest has been awarded and order issued for the establishment of the new rate not later than May 6.

Interest.—In a case involving reparation and interest the commission has found that the record was not convincing that 2 per cent. or any lower rate than 6 per cent. should be authorized as interest in this proceeding and has awarded reparation with interest at the rate of 6 per cent. per annum from the date on which the freight charges were paid. The defendant in this case contended that a 6-per cent. rate of interest no longer represented the value of the use of money inasmuch as lower rates were, when the shipments moved, and still are generally used and authorized in various forms of banking, credit and commercial enterprises applying charges for the use of money. It further contended that the interest should not exceed 2 per cent. The report states that the commission has allowed interest at the rate of 6 per cent. for the last 30 years and that this is the legal rate of interest in 38 states and the District of Columbia.—I. C. C. Docket No. 26,844, International Paper Co. *v.* Albany Port District Commission *et al.*

Examiners' Reports

Cement.—Examiner L. Way recommends that the commission dismiss the application of the D. & H. for authority to establish and maintain rates on cement from the Lehigh district of Pennsylvania and New Jersey to destinations in New England territories without observing the long-and-short-haul clause of Sec. 4. He claims that the percentage of circuity over the lines of the D. & H. is too great to entitle them to this relief.—I. C. C. FSA No. 16,494 and No. 16,523.

Examiner Charles M. Bardwell proposes that the commission find that the rates on cement intrastate in Kentucky result in undue, unreasonable, and unjust discrimination against interstate commerce. This is part of a proceeding dealing with various class and commodity rates in the state of Kentucky.—I. C. C. Docket No. 27,325, intrastate class and commodity rates in Kentucky.

Gravel.—Examiner D. C. Dillon recommends that the commission find that public convenience and necessity require the continuance of operation by Harley R. Warfield as a common carrier of gravel from Susquehanna, Pa., to points within a radius of 50 mi. of Hancock, N. Y.—I. C. C. Docket No. MC 50,841.

Sand.—Examiner Carl A. Schlager recommends an award of reparation of $126.17 with interest on a finding that the rate on silica sand from Ottawa, Ill., to Cleveland, O., of $3.15 was unreasonable to the extent that it exceeded $2.80 a ton not including emergency charges.—I. C. C. Docket No. 27,546.

New Complaints Filed

Sand.—Reparation is sought on an alleged violation of Sec. 1 in connection with sand from points in New York and New Jersey to Middletown, Conn., in a complaint filed by Abner Pollack, practitioner, New York, N. Y. —I. C. C. Docket No. 27,650, Wilcox, Crittenden & Co., Middletown, Conn., *v.* New Haven *et al.*

Sand and Gravel.—Alleging unreasonable charges on sand and gravel from Oreopolis, Neb., to Clarinda, Red Oak and Shenandoah, Ia., reparation is sought in a complaint filed by P. R. Wigton and E. L. Peterson, practitioners, Sioux Falls, Ia.—I. C. C. Docket No. 27,652, Booth & Olson, Inc., Sioux City, Ia., *v.* C. B. & Q.

Traffic News

Emergency Charge Cases.—Testimony on behalf of the railroads in emergency-charge case Ex Parte No. 115 has been concluded. The hearing will be resumed at the office of the commission in Washington at 10 a. m. Tuesday, March 23, when the lawfulness and propriety of the proposed increased rates upon the so-called heavy-basic-commodity list will be open for testimony on behalf of interested shippers or other opponents of the petition of the carriers. Included in the heavy-basic-commodity list under group 3 are the following: Gypsum rock; plaster retarder; patching plaster; lime (including agricultural lime, common lime, hydrated, quick or slaked; fluxing lime, land lime; land plaster, phosphoplaster and articles grouped therewith); plaster and articles grouped therewith; cement, natural, hydraulic, or Portland; and mortar.

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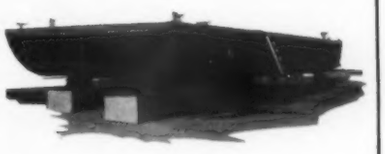

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New Machinery and Supplies

Crawler-Mounted Scrapers Have Definite Advantages

The tractor-equipment division of the Continental Roll & Steel Fdry. Co., East Chicago, Ind., announces a line of wagon scrapers mounted on crawlers.

The maker claims that equipping wagon scrapers with crawlers allows for their use more days a year, as the crawlers provide ample traction and load-carrying ability during a greater part of the wet season and allow for operation in wet soils and under conditions that would be impossible with wheeled scrapers. The use of crawlers also provides better traction when digging operations are in frozen, snow-covered ground.

The use of crawler units in no way affects the efficiency or speed of operation of Continental wagon scrapers and, in many cases, their use actually lessens the load on the tractor.

All sizes of Continental wagon scrapers,—5-, 7-, and 10-cu.yd. models—are available with crawler units, the 10-cu.yd. unit being available for field replacement on Continental wheeled wagon scrapers now in the field.

Crawler-mountings make this scraper adaptable to all weather and ground conditions.

Space-Saving Coupling Has Direct-Connecting Flange

Lovejoy Tool Works, 5033 West Lake St., Chicago, announces an L-R coupling of new design—the Type WF, which is made with one of the bodies in the form of a flange which bolts onto the flywheel, clutch or brake drum of a Diesel, gasoline or steam engine.

Flanged flexible coupling saves longitudinal space.

The flange-body design reduces the overall length of this coupling by one-third. It is apparent that this saving of space at an important point, allowing many more inches for frame and other parts, must add considerably to the efficiency and life of both drive and driven unit.

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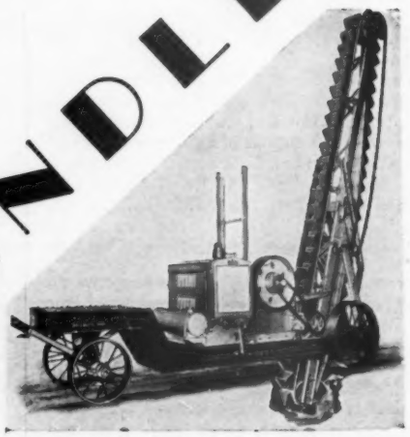

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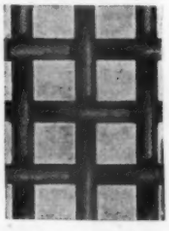

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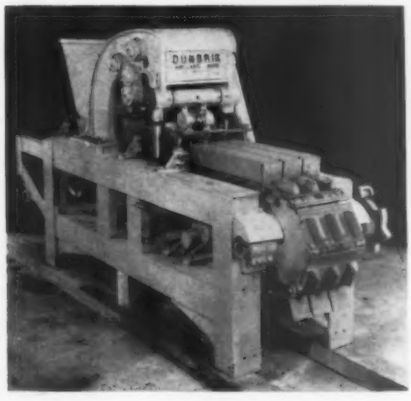
The W. E. Dunn Mfg. Co., Holland, Mich., has announced a new standardized production plant with many new features. In operation the plant is a model of efficiency. The dry raw materials are elevated and automatically dumped into a shovel-type mixer where the proper water content is added by the operator from the ground floor through a measuring device, thereby assuring a uniform



Concrete-brick machine making three large units at a time.

water content which is vitally essential to produce the greatest possible density and strength. The material, after mixing, is discharged into the hopper of the automatic Dunbrik machine where it passes on to a continuous, cast-steel, machined traveling carrier which consists of a series of mold boxes which pass under a heavy tamping and troweling mechanism which tamps and trowels the material at 600 strokes per min. The finished units are then removed to racks and taken to a storage yard.

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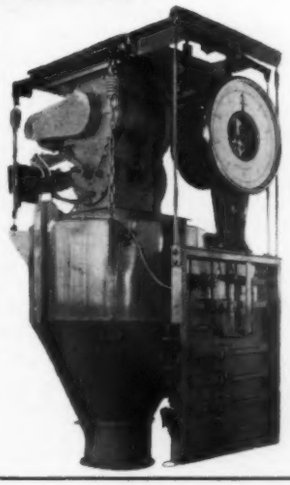

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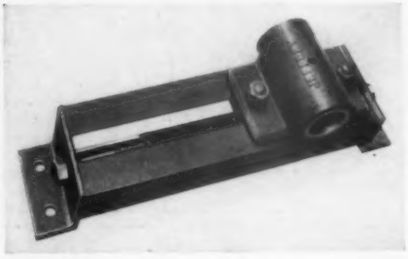


Adjustable take-up for conveyors and elevators.

sliding base casting, which carries an adjustment nut of bronze, is cored out in such a way that it slides freely over the shield, thus relieving the shield of any function other than of protecting the screw. As the adjusting screw does not travel but remains inside the frame, it is protected from damage at all times. The screw is also protected from operating strains and shocks, in fact relieved of all load; for, after adjustment, the bearing is rigidly clamped to the rugged steel frame.

New Clamps Are Effective for Stopping Leaks in Pipe

Easily-applied clamps for permanently stopping leaks in pipes, regardless of how large or small, whether high or low pressure, are in valuable use today—on pipe lines carrying air, gases, heavy or light liquids, solutions, etc. They are applied while pipe lines are in service except upon extremely high-pressure lines.

The increasing demand for pipe clamps of this type, as well as the higher pressures being adopted in pipe lines today, are responsible for the radically redesigned pipe clamp, a product of the M. B. Skinner Co., South Bend, Ind.

The new specifications for these clamps require a metal of higher tensile strength, uniform density and hardness—a metal composition which was adopted regardless of price because of its suitability. To absolutely insure that every clamp is as perfect as humanly possible, this company has installed sufficient new testing equipment to test every clamp under a pressure of 3000 lb. before it leaves the factory.

NOW YOU CAN HAVE

Longer

PIPE SERVICE!

Uniweld Pipe materially reduces pipe costs, especially in handling abrasive material. Made of special high carbon-high manganese steel it outlasts other pipe by a good margin. By its longer service it also reduces the cost of handling and replacing pipe.

Uniweld Pipe can be furnished in various lengths, diameters and ends to suit your particular requirements—and it compares in original price with other pipe. Write for information.

THE UNITED WELDING CO.
MIDDLETOWN, OHIO

UNIWELD PIPE

WELDING ENGINEERS · UW CO · MIDDLETOWN, OHIO.

STURTEVANT

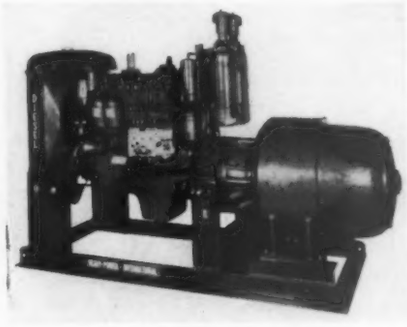
AIR SEPARATORS

are the modern means of producing extremely fine products and increasing Mill capacities. Tell us of your problem.

STURTEVANT MILL CO.
Harrison Square, BOSTON, MASS.

Electric Plants Have Several Outstanding Features

A line of complete, self-contained Diesel engine electric generator sets, rated at 30, 37½, 45 and 60 k.v.a. is being manufactured by the Ready-Power Co., Detroit, Mich. These plants are powered by International Harvester PD-40 and PD-80 engines. Generator equipment is bolted rigidly to the flywheel housing of the engine and alignment is permanently secured by means of a heavy machined casting which



Diesel-driven electric plant.

is piloted to the end bell housing and to the rear-end bell of the generator. This unit construction reduces vibration and makes unnecessary the heavy cast-iron base formerly used for generator plants of this size.

Generators are of two ball-bearing construction. The armature shaft is connected to the engine flywheel through a "no-back-lash" flexible coupling.

The Diesel engines used in these machines are unique in that they are started and warmed up as gasoline engines. After the engines are thoroughly warmed up they operate on full Diesel cycle for full Diesel economy. Simple, automotive-type electric starting is provided.

The plant illustrated is one of three units recently shipped out of Detroit for flood duty. The order for this particular set was received at 8:30 p.m. and was shipped at 4:30 the following morning for use at radio station WCKY at Covington, Ky.

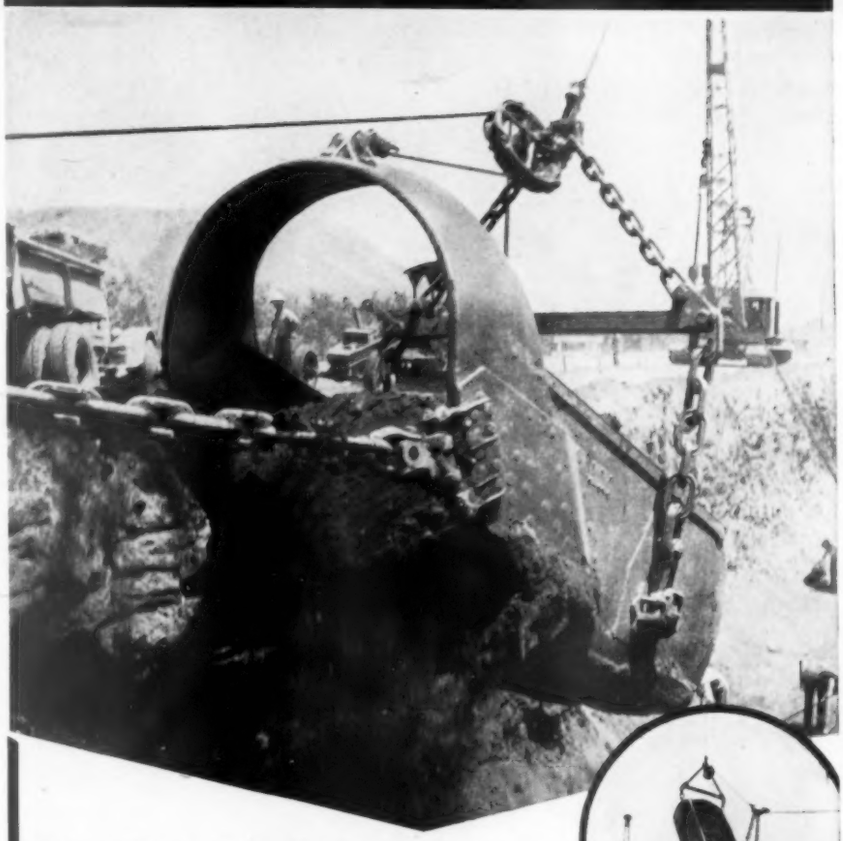
In addition to these Diesel plants, the Ready-Power Co. manufactures a complete line of electric plants for natural gas, gasoline or kerosene operation rated at 1 to 60 k.v.a. All are powered by International Harvester engines.

Moving Floor Allows Truck Loads to Be Dumped Quickly

A unique development in truck-body design, a movable floor which simplifies loading and unloading, has been introduced by the Easton Car & Construction Co. The product is called the "Loryflor" and truck bodies incor-

How unloading is simplified with the movable floor in the truck body.

Speed up DRAGLINE WORK 20% to 50% with a PAGE AUTOMATIC



Users Report On Yardage Increases Read Their Results:

One Contractor writes:

"Excavation was around walls and involved the digging of hard clay to a depth of 28 feet. This work was completed in three months—one-half the time we figured necessary."

Another AUTOMATIC owner reports:

"We are stripping 25 feet overburden, some of which is hard pan and rock. Since putting on the AUTOMATIC we are stripping at least 50% more material." * From letters in our files

Ask any AUTOMATIC owner or operator about their yardage records with the patented rounded front AUTOMATIC bucket! Then see your equipment dealer or write us direct for information on a size and weight bucket best suited for your machine and job. Bulletin "THE AUTOMATIC" gladly sent on request.

BUILT IN SIZES 3/8 to 15 CUBIC YARDS

DIG WITH A PAGE AUTOMATIC

Address: Department F

PAGE ENGINEERING COMPANY

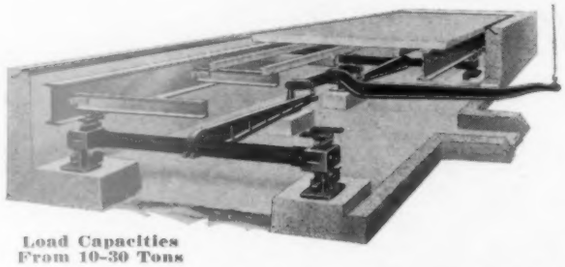
CLEARING POST OFFICE CHICAGO, ILLINOIS

FRICTION vs ACCURACY in Your Weighing

As truck loads of stone, sand, gravel or other non-metallic mineral products pass over your scale, there is a constant sifting, clinging of silt and dust to the vital scale parts—a cause of added friction and a challenge to the accuracy of your weighing.

The HOWE Commercial Motor Truck Scale defies friction with its simple, powerful lever system and minimum number of moving parts under the platform (only 15). Fewer moving parts mean less friction; less friction means longer periods of sustained accuracy.

This is only one vital feature that has given the HOWE Commercial Motor Truck Scale its reputation for accuracy over a period of 80 years. Ask our representative about other features, including Ball-Bearing protection of scale pivots; or write to The Howe Scale Company, Dep't P-2, Rutland, Vermont.



Load Capacities
From 10-30 Tons

Branches and warehouses in principal cities

HOWE Scales

HOWE FAMOUS FIRST IN 1857

porating this design are to be called Loryflor bodies. This new floor consists of a single sheet of extremely durable cord rubber belting supported beneath by tiers of steel rollers. The belting is long enough to be rolled one complete floor length to either end of the truck. This complete movement of the floor from end to end of the body provides a new and different method of loading and unloading.

The Loryflor is operated by means of a crank handle which is used to roll up the floor. The operator may use this handle at either end, or either side of the truck. It requires very little effort for one man to move the load in or out of the body regardless of the weight or nature of the load.

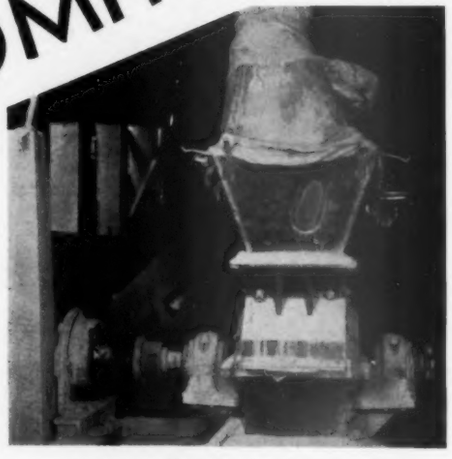
A complete movement of the floor from end to end of the body can be accomplished in a few seconds. At all times the loading or dumping action is absolutely controlled by the operator. Almost any type of load such as sand, gravel, stone, etc., can be handled.

Announces Improvements in Alloy-Steel Kiln Ends

During the past six or seven years there has been a steady increase in the use of heat-resisting alloys in the manufacture of cement. One of the pioneers in this field was the Chicago Steel Foundry Co. One of the specialties developed by this concern has been Pyrasteel kiln ends. The first kiln ends were made in a one-piece solid ring. By attaching to a kiln proper and lining with fire-brick, tight sealing with marked fuel economy was at once possible, and in addition to that these kiln ends when installed proved good for years of continuous service. Many different installations in cement mills, and under widely varying conditions, enable this company to suggest the most practical design to fit any given situation.

Experience with Pyrasteel kiln ends in actual service have resulted in the practice of generally making them in four segments, joined together with butt straps, a brick retaining flange at the outer end and with the attaching end either flanged or straight depending on the desired method of attaching to the kiln. The advantage of the segmental kiln ends over the solid rings is obvious. Being made in segments they can be cast in lighter section. They allow more accurate adjustment for fitting to the kiln. In the case of repairs one segment may be replaced without scrapping the entire installation and because the kiln shell expands and contracts more readily than Pyrasteel, the segments allow an adjustment in the arrangement of the cored holes so that the ring does not warp, distort or crack.

FINISH GRINDING DOLOMITE



The American Way

The production of this important fertilizer material demands the most efficient type of equipment . . . and the American Rolling Ring Pulverizer is specified for the job to insure low costs and high capacities. It is used with highly satisfactory results for the final processing operation in a leading southern plant. A year's successful operation proves that a cheaper, better product can be made "The American Way."

AMERICAN PULVERIZER

in action at the Sarasota plant of Florida Dolomite Co. *Write for Bulletin.*

AMERICAN PULVERIZER COMPANY

1245 MACKLIND AVENUE ST. LOUIS, MISSOURI

Coming Events

March 16-18, 1937, Chicago, Ill.—Annual meeting, American Railway Engineering Assn., Palmer House.

April 12-15, 1937, Chapel Hill, N. C. — Semi-annual meeting, American Chemical Society.

April 21-24, 1937, San Antonio, Tex. —Spring meeting, American Society of Civil Engineers.

June 28-July 2, 1937, New York, N. Y.—Fortieth annual meeting and exhibit, American Society for Testing Materials. Waldorf-Astoria Hotel.

Announcement is made by the Link-Belt Co. of the appointment of P. B. Engstrom as its distributor for crawler shovels, draglines and cranes in Los Angeles and southern California territory. He is making his headquarters at the Link-Belt office in Los Angeles, 361-369 S. Anderson St.

In a new 32-p. catalog No. 37 just issued by R. C. Stanhope, Inc., 101 W. 31st St., New York, N. Y., more than 2,000 pieces of equipment for use in the nonmetallic-minerals field are listed. Some of the machinery is new and unused, while other items are rebuilt and in excellent condition.

Trade Literature

Nordberg Diesel Engines. 20 p. Nordberg Mfg. Co., Milwaukee, Wis.

Fairbanks-Morse Duplex Power Pumps. 12 p. Fairbanks, Morse & Co., Chicago, Ill.

Dardelet—the Self-Locking Screw Thread. 32 p. Dardelet Threadlock Corp., New York, N. Y.

Byron Jackson Sand, Gravel and Rock Pumps. 8 p. Byron Jackson Co., Los Angeles, Cal.

The Worthington Rock Master. 12 p. Worthington Pump & Machinery Corp., Harrison, N. J.

Worthington Screw-Feed Drifters. 4 p. Worthington Pump & Machinery Corp., Harrison, N. J.

The Explorer Diamond Drill. 8 p. Ingersoll-Rand Co., Phillipsburg, N. J.

Rex Chains.—Griplock, Roller, Z-Metal. (Folders.) Chain Belt Co., Milwaukee, Wis.

Austin-Western Equipment. 24 p. Austin-Western Road Machinery Co., Aurora, Ill.

Good Roads—Standardized Material Handling Machines. 52 p. Barber-Greene Co., Aurora, Ill.

Electrostatic Precipitators for Industrial Air Cleaning. 6 p. Pangborn Corp., Hagerstown, Md.

The Motorblower for Cupola Blowing. 12 p. Ingersoll-Rand Co., Phillipsburg, N. J.

Screen Cloth for Vibrating Screens. 12 p. (Bulletin No. 98.) Robins Conveying Belt Co., New York, N. Y.

Marmon-Herrington All-wheel Drive. 6 p. Marmon-Herrington, Inc., Indianapolis, Ind.

Low Cost Roads Stabilized with Aggregates, Binder Soil and Calcium Chloride. (Bulletin No. 25.) Calcium Chloride Assn., Detroit, Mich.

Use an Aërial Tramway for Storing Sand, Gravel, Stone. 4 p. American Steel & Wire Co., Chicago, Ill.

G. E. Temperature Relays. 4 p. General Electric Co., Schenectady, N. Y.

Klamp-Tite Knife Switches. 4 p. I-T-E Circuit Breaker Co., Philadelphia, Pa.

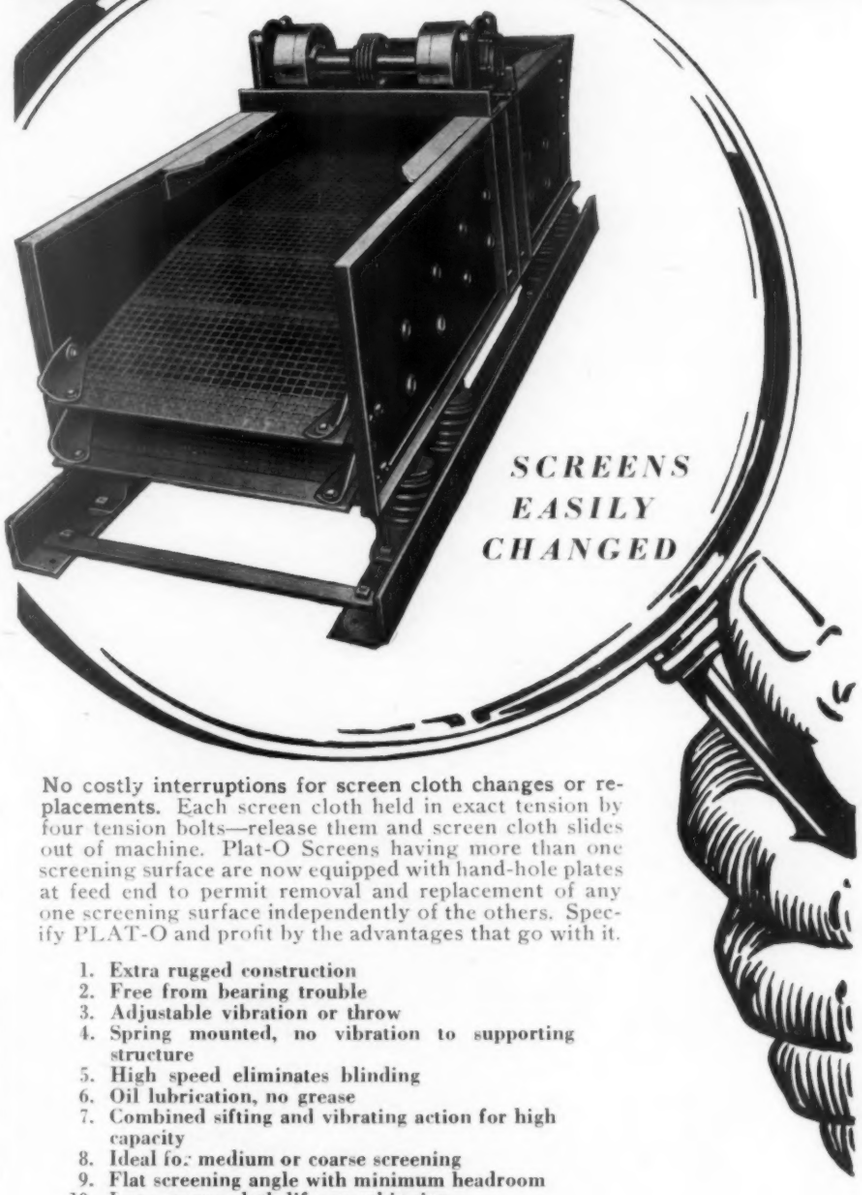
Western Stationary Diesel Engines. 8 p. Western Engine Corp., Los Angeles, Cal.

Economy Pumps—Engineering Data and Prices. 233 p. Economy Pumping Machinery Co., Chicago, Ill.

Durolite All-Steel Wire Rope Blocks. 8 p. Sauerman Bros., Inc., Chicago, Ill.

Concrete Piles—Design, Manufacture, Driving. 80 p. Portland Cement Assn., Chicago, Ill.

Plat-O Screens stand close inspection



No costly interruptions for screen cloth changes or replacements. Each screen cloth held in exact tension by four tension bolts—release them and screen cloth slides out of machine. Plat-O Screens having more than one screening surface are now equipped with hand-hole plates at feed end to permit removal and replacement of any one screening surface independently of the others. Specify PLAT-O and profit by the advantages that go with it.

1. **Extra rugged construction**
2. **Free from bearing trouble**
3. **Adjustable vibration or throw**
4. **Spring mounted, no vibration to supporting structure**
5. **High speed eliminates blinding**
6. **Oil lubrication, no grease**
7. **Combined sifting and vibrating action for high capacity**
8. **Ideal for medium or coarse screening**
9. **Flat screening angle with minimum headroom**
10. **Long screen cloth life, no whipping**
11. **SCREEN CLOTHS EASILY AND QUICKLY CHANGED**
12. **No eccentrics, fewer bearings, fewer repairs**

Watch for another Plat-O super-feature next month. Its fast-growing popularity is based on performance. Write for Bulletin for full details.

DEISTER MACHINE CO.

1933 E. Wayne Street **Fort Wayne, Indiana**

Emil Deister, Sr., Pres.; I. F. Deister, V. Pres.

Emil Deister, Jr., Secy.-Treas.

The Profit Sharing Auxiliary of Commerce

By Ernest V. Madison

Good advertising is a mutual profit distributor.

Financially speaking, an advertiser underwrites the initial expense of the advertising campaign. Additional sales and lower cost of production repay to him the amounts advanced for preparation, printing, postage and publication. The cost **vanishes.**

The buyer of the advertised product does not pay a cost for the advertising—**he saves through it.**

The automobile is a product advertised extensively but cars do not cost more because of this advertising. **We have had frequent price reductions through recent years.** Automobile manufacturers have not been penalized financially because of their advertising outlay. **They are in a stronger capital and profit position than ever before.**

The cost of advertising is absorbed by the operating and merchandising economies of an increased business. Ultimately, these economies are passed on to the buyer in the form of a lower price or higher quality.

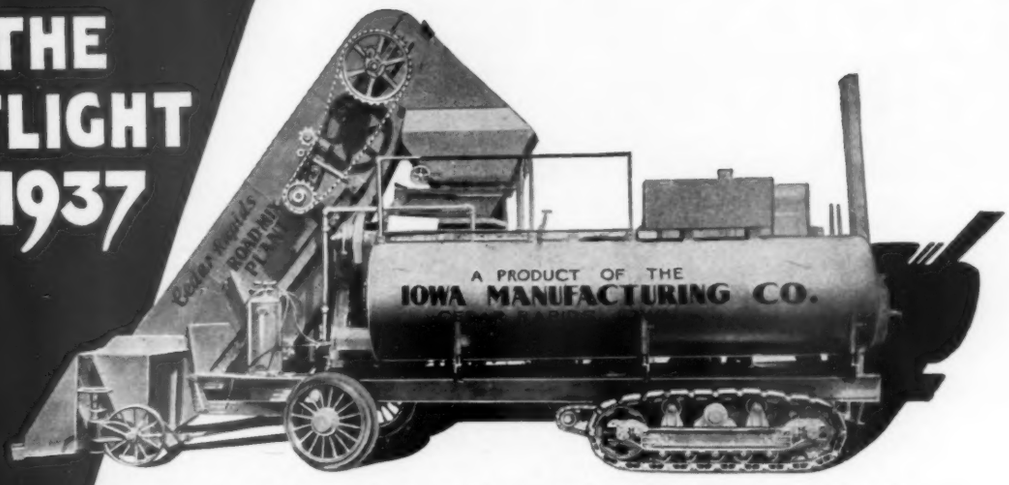
* * *

The advertisers in **PIT AND QUARRY** are deserving of our encouragement.

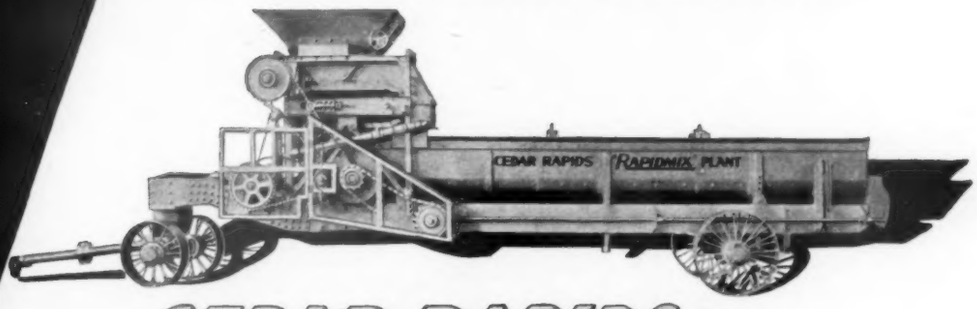
They are advertising to obtain new customers—to grow—to reduce seasonal or intermittent **wastes** of idle machines, idle operatives, and idle floor space.

These are laudable ambitions.

IN THE SPOTLIGHT FOR 1937



CEDAR RAPIDS TRAVELING ROADMIX PLANT



CEDAR RAPIDS RAPIDMIX PLANT

STOP GUESSING!

★ Build better Blacktop roads at lower costs.

★ Use a CEDAR RAPIDS Plant --- for greater

ACCURACY «» CAPACITY «» PORTABILITY

We build a complete line of portable hot or cold asphalt plants and dryers

Write for bulletins

IOWA MANUFACTURING COMPANY

CEDAR RAPIDS «» «» IOWA «» «» U. S. A.

BUYERS' GUIDE

A Directory of Pit and Quarry Advertisers Indexed According to Product.

Although every effort is made to insure accuracy and completeness in these listings, the publisher cannot accept responsibility for errors or omissions. Any mistakes discovered will gladly be rectified.

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*Warren Brothers Roads Co.

Agitating Ladders (Dredge)
*Eagle Iron Works

Agitators, Thickeners and Slurry Mixers
*Hardinge Co.
*Manitowoc Engineering Works
*Traylor Engr. & Mfg. Co.

Aggremeters
*Blaw-Knox Co.
Johnson Co., C. S.

Air Compressors (Portable)
*Curtis Pneumatic Machinery Co.
*Fuller Co.
O. K. Clutch & Machinery Co.
*Traylor Engr. & Mfg. Co.
Worthington Pump & Machy. Corp.

Air Compressors (Stationary)
*Curtis Pneumatic Machinery Co.
*Fuller Co.
O. K. Clutch & Machinery Co.
*Traylor Engr. & Mfg. Co.
Worthington Pump & Machy. Corp.

Air Filters
*Blaw-Knox Co.
*W. W. Sly Mfg. Co.
*Western Precipitation Co.

Air Pumps
*Fuller Co.
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Air Separators
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*Hardinge Co.
*Raymond Bros. Impact Pulv. Co.
*W. W. Sly Mfg. Co.
Sturtevant Mill Co.
*Williams Patent Crusher & Pulverizer Co.

Alloys (Steel)
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Chain Belt Co.
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Manganese Steel Forge Co.
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Ash and Refuse-Handling Equipment
*Allen-Sherman-Hoff Co.
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*Warren Brothers Roads Co.

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*Fuller Co.
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*Jeffrey Mfg. Co.
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Manganese Steel Forge Co.

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*Hardinge Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Manganese Steel Forge Co.

Barges (Steel)
American Steel Dredge Co.
*Manitowoc Engineering Works

Baskets (Dipping)
Buffalo Wire Works Co.

Batteries
Goodyear Tire & Rubber Co.

Bearings (Anti-Friction)
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Hetherington & Berner, Inc.
*Jeffrey Mfg. Co.
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*Robins Conveying Belt Co.
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Timken Roller Bearing Co.

Bearings (Ball)
S. K. F. Industries, Inc.

Bearings (Roller)
S. K. F. Industries, Inc.
Timken Roller Bearing Co.

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Belt Fasteners
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*Cincinnati Rubber Mfg. Co.
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Republic Rubber Co.
*Robins Conveying Belt Co.
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Republic Rubber Co.

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Bin-Dicator Co.

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*Fuller Co.
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*Link-Belt Co.
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McLanahan and Stone Corp.
*Pioneer Gravel Equip. Mfg. Co.
*Robins Conveying Belt Co.
Universal Crusher Co.

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Blasting Supplies
Du Pont de Nemours & Co Inc.
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Hug Co.

Bodies (Motor Truck, Concrete Mixing)
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Chain Belt Co.
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Blowers
*W. W. Sly Mfg. Co.
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Dunn Mfg. Co.

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Dunn Mfg. Co.

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National Wire Cloth Co.
*Tyler Co., W. S.

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Buckets (Clamshell, Orange-Peel, Etc.)
*Bartlett & Snow Co., C. O.
*Blaw-Knox Co.
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*Harnischfeger Corp.
*Link-Belt Co.
Owen Bucket Co.
Wellman Engr. Co.

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*Bartlett & Snow Co., C. O.
*Bucyrus-Erie Co.
*Link-Belt Co.
*Page Engr. Co.
*Pioneer Gravel Equip. Mfg. Co.
*Sauerman Bros., Inc.
Wellman Engr. Co.

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*Bartlett & Snow Co., C. O.
Chain Belt Co.
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*Hendrick Mfg. Co.
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*Jeffrey Mfg. Co.
*Link-Belt Co.
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*Robins Conveying Belt Co.
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*Link-Belt Co.
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Car Pullers
*Bartlett & Snow Co., C. O.
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*Link-Belt Co.

Carriers
*Bartlett & Snow Co., C. O.
*Jeffrey Mfg. Co.
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*Bartlett & Snow Co., C. O.
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Chicago Steel Foundry Co.
*Eagle Iron Works
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*Jeffrey Mfg. Co.
*Link-Belt Co.

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*Bartlett & Snow Co., C. O.
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Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
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*Bartlett & Snow Co., C. O.
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*Hendrick Mfg. Co.
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*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
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*Link-Belt Co.
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*Roebling's Sons Co., John A.

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*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
Bonnot Co.
*Hardinge Co.
*Jeffrey Mfg. Co.
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*Raymond Bros. Impact Pulv. Co.
*Williams Patent Crusher & Pulverizer Co.

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*Curtis Pneumatic Machinery Co.

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*Deister Concentrator Co.

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*Blaw-Knox Co.
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*Koehring Co.

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*Koehring Co.

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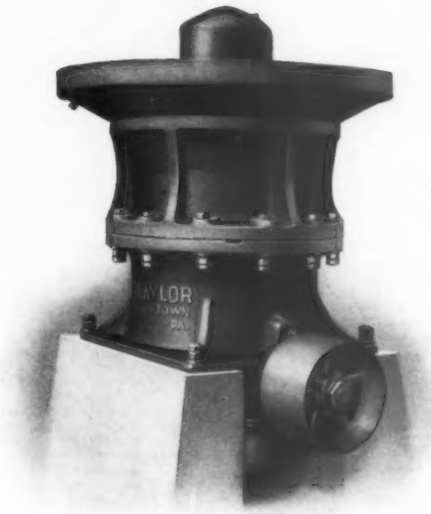
Iowa Mfg. Co.
*Link-Belt Co.
Smith Engr. Works

* See also information in the 1936 Pit and Quarry HANDBOOK.

TRAYLOR
TYPE TY REDUCTION CRUSHER



TWO USERS

wrote us recently,—and voluntarily—expressing their unqualified approval, in enthusiastic terms, of their Traylor Type TY Reduction Crushers. They are only two of many hard-headed operators who have learned what they wanted in a reduction crusher by the expensive process of NOT finding it in numerous machines they have tried. Having FOUND it in a Traylor TY, naturally they like to "tell the world" they did!

All of the whys and wherefores are printed in our bulletin No. 112. Send for your copy now!

TRAYLOR
ENGINEERING & MFG. CO.
Allentown, Pa.

NEW YORK CITY 3916 Empire State Bldg. | CHICAGO 2151 One La Salle St. Bldg. | SALT LAKE CITY 101 West Second South St.
LOS ANGELES 919 Chester William Bldg. | SEATTLE 6311 22nd Ave., N. E. | Timmins, Ontario, Canada P. O. Box 113
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European Works—Usines Carels Freres, Ghent, Belgium

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tough going - but the Michigan is tougher!

Michigan Shovels are built for frozen ground—soft fills—gravel pits—rock quarries—mud—in fact, for anywhere a truck can navigate! . . . Although constructed for heavy duty and long life, the Michigan is not a ponderous, slow-moving machine. Its 25 mile-per-hour road speed gets it on the job and *earning* long before heavier equipment could be transported—and at a fraction of the cost . . . Model T-6 is faster in operation, too, due to fingertip air-controlled clutches and full-circle loading . . . Michigan's quick convertibility solves more of today's construction and maintenance problems than any other like equipment . . . Get Bulletin "P." Write—

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Just look! at that RUGGED FRAME made of HIGH TENSILE STEEL – double the strength of ordinary frames. Typical of the BALANCED STRENGTH found throughout the MICHIGAN

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*W. W. Sly Mfg. Co.
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*Jeffrey Mfg. Co.
*Link-Belt Co.

* See also information in the 1936 Pit and Quarry HANDBOOK.

Hauls *100 tons* per hour at *1.7 cents* per ton

● The economy of track haulage, and the efficiency of Whitcomb Locomotives have written many new records on haulage expense sheets. In deep or shallow quarries, on uneven track, around sharp curves, they have the balance that holds the track and power that moves the load with speed and economy.

The husky, compact Whitcomb Locomotive shown above is owned by the Bird Dog Mine at Cardin, Oklahoma. It handles the entire haulage operation covering 800 acres —supplies more than 100 tons of ore per hour to the mill, at a haulage cost that never exceeds 1.7 cents per ton. Whitcomb Locomotives eliminate standby fuel losses—time lost in getting up steam, handling coal and cleaning fires.

There is a size of equipment suited specifically to your requirements

Gasoline or Diesel Mechanical Drive
Gasoline or Diesel Electric Drive
Electric Storage Battery
Electric Trolley
Combination Trolley—Storage Battery

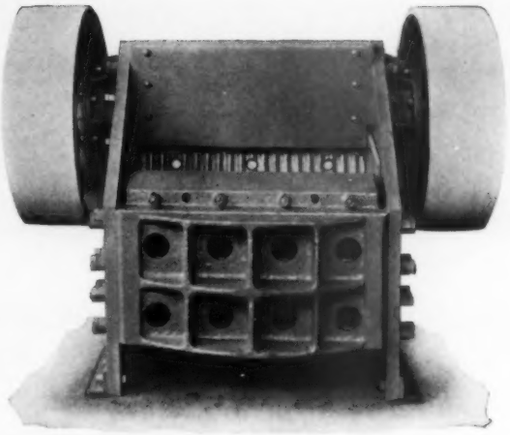
●

Whitcomb Engineers will survey your requirements and estimate the savings you can make by an investment in Whitcomb equipment.

THE WHITCOMB LOCOMOTIVE CO.

Subsidiary of The Baldwin Locomotive Works Plant at Rochelle, Illinois. All sales made by The Baldwin Locomotive Works, Paschall Station Post Office, Philadelphia, Pa.

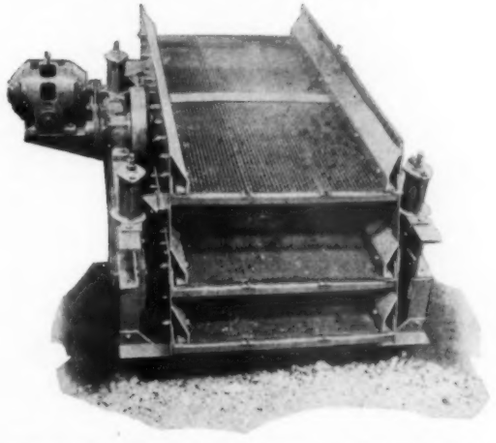
WHITCOMB LOCOMOTIVES



HOW TO MAKE CHIPS

With a GOOD ROADS "2-in-1" primary-reduction crusher you can quickly switch from turning out larger sizes to producing ample tonnage in *profitable chips.*

GOOD ROADS MACHINERY CORP.
KENNETT SQUARE, PENNSYLVANIA



GOOD ROADS MACH. CORP., Kennett Square, Pa.
Please send me information on items checked below:

☐ Crushers ☐ Feeders ☐ Elevators
☐ Conveyors ☐ Wash Boxes
☐ Vibrating Screens ☐ Revolving Screens

Name..... City.....

Address..... State.....
PQ

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*Jeffrey Mfg. Co.
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*American Steel & Wire Co.
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Coast Cable Co.
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*Hazard Wire Rope Division of the American Chain & Cable Co., Inc.
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Macwhyte Company.
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Rochester Ropes, Inc.
*Roebling's Sons Co., John A
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*Wickwire Spencer Steel Co.
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*Bartlett & Snow Co., C. O.
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*Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
*Bucyrus-Erie Co.
Erie Pump & Engine Works
Hetherington & Berner, Inc.
*Morris Machine Works
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*Allis-Chalmers Mfg. Co.
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*Morris Machine Works
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*Jeffrey Mfg. Co.
*Link-Belt Co.
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*Hardinge Co.
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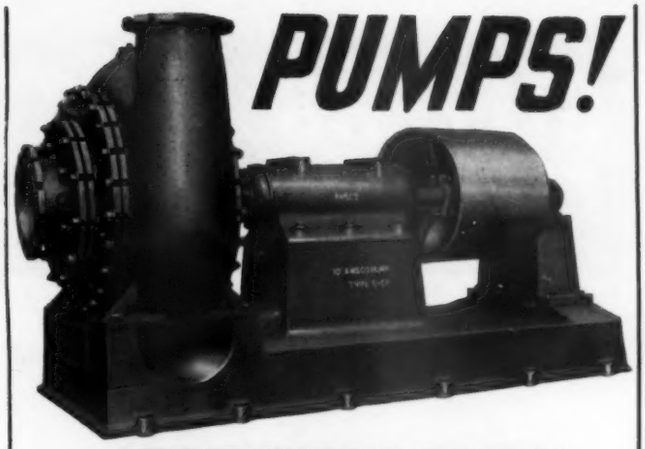

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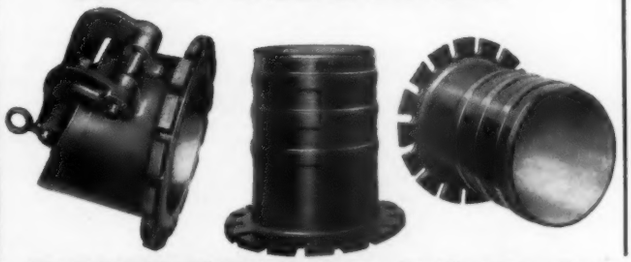

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BUYERS' GUIDE

A Directory of Pit and Quarry Advertisers Indexed According to Product.

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*Hendrick Mfg. Co.
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*Portable Machy. Corp.
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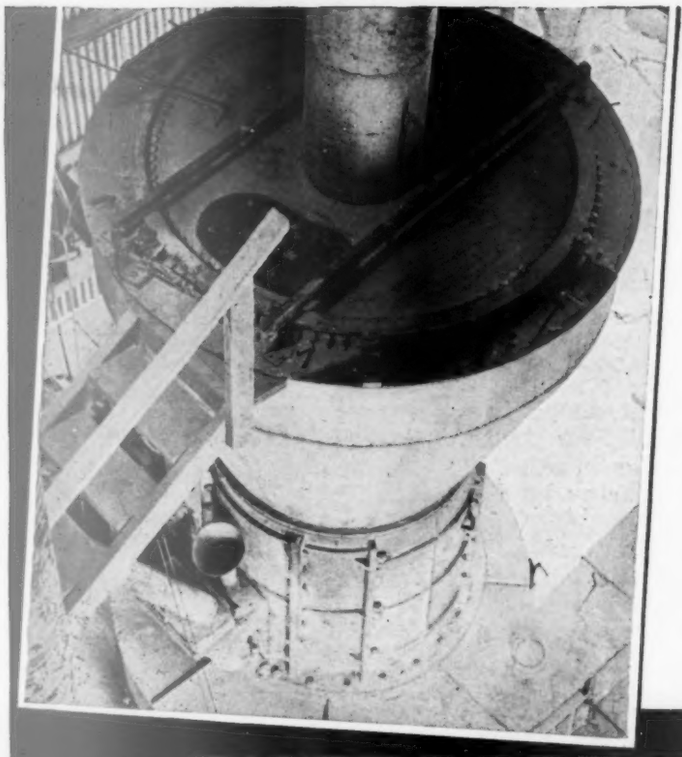

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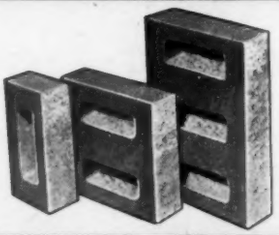

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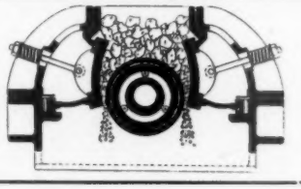
BONNOT Reduction Crushers

REDUCES OPERATING COSTS

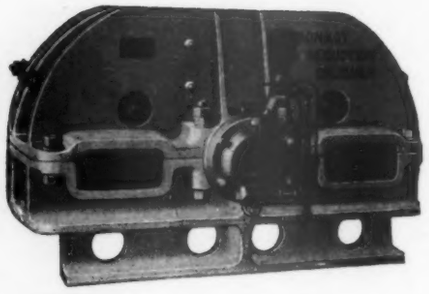


ACTUAL OPERATING RECORDS

over a long period of time have produced a record for low cost operating that deserves your careful consideration. Lower costs are due to rugged construction, fewer parts and even distribution of wear.

Power savings of 50% or more, as shown by field tests—producing 30 tons per hour of 1" minus material with less than 10 HP.

The Bonnot is not a roll crusher and has no troublesome gears, countershaft or eccentric sleeves. The slow creep mantle is a real advance in crusher design to distribute wear evenly.



Manufactured Under U. S. Pat. No. 1,946,763

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FEATURES—

Simplicity
Ruggedness
No Choking
Long Life
Low Upkeep
Low Headroom
High Capacity
Low Power

Crushers
Hammer Mills
Pulverizers
Aggregate Dryers
Rotary Kilns
Feeders

BONNOT CO.

CANTON, OHIO

Since 1891

New York Office—30 Church St.

NEW FREE

Manganese Steel Handbook

Only 32 pages, but crammed full of information as to "where" and "how" and "why" Rol-Man will last longer where tough-hardness, strength and abrasion resistance is required. Hundreds of parts we have made in the last 15 years are alphabetically listed, to give a comprehensive picture of the type of service where Rol-Man excels. If you are troubled with the bugaboo of excessive wear and frequent breakage of any forged, rolled or pressed steel part, we feel sure this booklet will be most interesting.

True MANGANESE STEEL

FORGINGS Rolled Products ROL-MAN STAMPINGS Wire & Rod Products

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TORO

GRINDER and SCREENER

GRINDS AND SCREENS IN ONE OPERATION

This is a substantially built machine with a sturdy steel chassis. There are very few moving parts to wear out, and its record of economy on repairs in actual service is remarkable. It has a capacity of 5 to 7 yards per hour, and can keep five men continually busy. The machine comes equipped with a screen 5 feet long by 3 feet in diameter, made of 16 gauge wire in any size mesh from 1/8 to 1/2 inch. It can be operated by any motor of 4 H.P. or over, or from a power take-off on a tractor

Sand and gravel men who have used it say for low cost production it has no equal.

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TORO ALL OVER THE WORLD

TORO MANUFACTURING CORPORATION

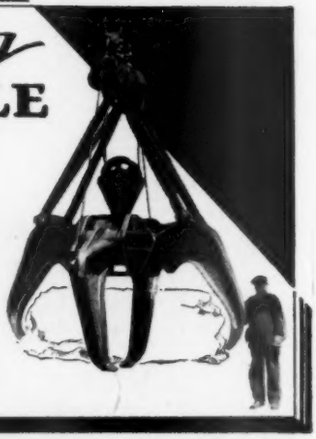
3042 SNELLING AVENUE MINNEAPOLIS, MINNESOTA

ALL 4 TINES Effective At Every Grab

with Octopus-Like cunning

The OWEN TYPE "RA" GRAPPLE

grips and lifts rocks, regardless of shape... Each of 4 tines makes contact with the rock, handling its share of the load. Easier placement and greater security of grip assure increased tonnage in handling rocks, scrap iron, timbers, etc. Write for new bulletin.



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Branches: NEW YORK • PHILADELPHIA • CHICAGO • BERKELEY, CAL.

New Holland for *New Economy*

Advanced features like the pulsating feeder that increases the efficiency of the New Holland Roll Crusher—and the positive circular motion principle that gives better and faster grading with the New Holland Vibrating Screen—these are the reasons for the extra profits that producers obtain in using New Holland equipment.

Bulletins on request

Vibrating Screens: six sizes, one to three decks. Perfect balance—no base vibration.

Roll Crushers: capacities to 75 tons per hour.

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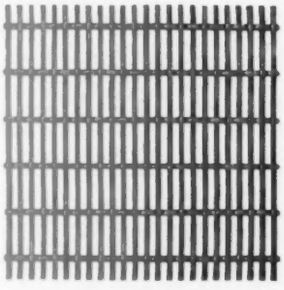

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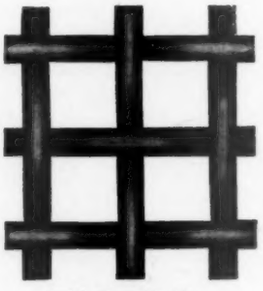
ALLOY No. 2

A super wearing Steel developed to resist the abrasion and vibration of modern screening demands.

"CLEVELAND" SCREENS

A wire cloth of guaranteed accuracy backed by fine workmanship and an effort to satisfy.

Available in Square Mesh and Rolled Slot. A trial will convince you of the superiority.



2 Mesh .162 Ga.

THE CLEVELAND WIRE CLOTH & MFG. COMPANY
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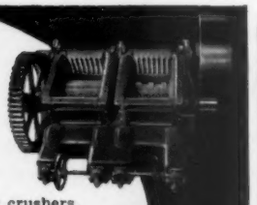
McLANAHAN EQUIPMENT

for ROCK—
SAND—GRAVEL



Single and double roll and jaw crushers, hammer mills, super dry pans, steel log washers and scrubbers, sand drags, revolving and vibrating screens, elevators, conveyors, dryers, jigs, hoists. Complete portable, semi-portable and stationary crushing, screening and washing plants for different capacities of any materials.

McLanahan & Stone Corporation
Established 1835
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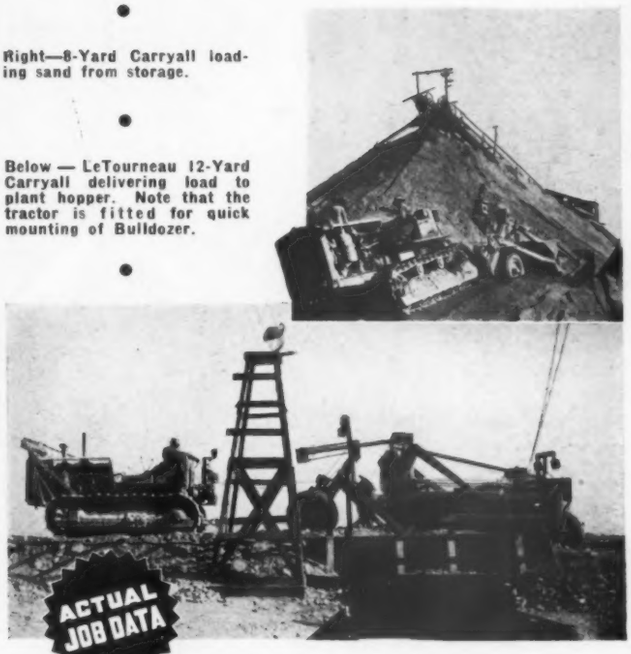
In Philadelphia it's the

HOTEL PHILADELPHIAN

FORMERLY HOTEL PENNSYLVANIA
600 ROOMS WITH BATH FROM $2.50 UP
39th and CHESTNUT STREETS
PHILADELPHIA, PENNA.

Right—8-Yard Carryall loading sand from storage.

Below — LeTourneau 12-Yard Carryall delivering load to plant hopper. Note that the tractor is fitted for quick mounting of Bulldozer.



GRAHAM BROTHERS GET 150 TONS HOURLY

On a 1200-Foot Haul

When other methods of handling material proved unsatisfactory, Graham Brothers, operators of seven aggregate plants in southern California, tried a LeTourneau 12-Yard Carryall and Caterpillar Diesel. Today, at their El Monte plant, LeTourneau equipment and tractors profitably handle the entire operation from excavating to stockpiling. The original 12-Yard Carryall and tractor digs and delivers to the plant an average of 150 tons hourly on a haul of 1200 feet. A LeTourneau Bulldozer mounted on the same tractor prepares drive-ways and handles the harder digging; an 8-Yard Carryall does the stock-piling.

Ask your Caterpillar tractor dealer to demonstrate what this flexible setup of LeTourneau equipment and Caterpillar tractors can do for you.

R. G. LE TOURNEAU, Inc.

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Cable Address: "Bobletorno"

Manufacturers of: Angledozers*, Bulldozers, Carryall* Scrapers, Buggies*, Cranes, Drag Scrapers, Power Control Units, Rooters*, Semi-Trailers.

* Name registered U. S. Patent Office.

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NON BLINDING

POSITIVE ACTION

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GYRATING SCREENS

Screening, grading and material separation under the most severe conditions need no longer be a costly operation, if performed on these scientifically engineered screens. High grade bearings, effectively used power, positive action, sturdy construction—all contribute to maximum efficiency in screening, low operating cost and minimum maintenance. Write for descriptive folder.

SIMPLICITY ENGINEERING COMPANY

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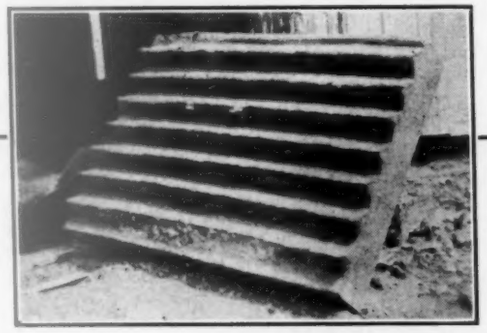

Returned to Service

Here's real economy — after this Jaw Crusher Plate had worn practically smooth, it was completely rebuilt with

MANGANAL ROUND APPLICATOR BARS AND WELDING ELECTRODES

and made serviceable again at very small cost. Often a few pounds of metal will save buying new and expensive equipment in cases like this.

Applicator (Filler) Bars are recommended for use where deposition of large amounts of metal is required for building up manganese and carbon steel surfaces, such as Gears, Lips and bucket parts, Caterpillar Treads, Crusher Bells and Liners, Dredge Pump Shells, Impellers and Plates.

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THERE'S COMFORT.
CONVENIENCE.
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OUTSIDE ROOMS

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EACH ROOM HAS TUB AND SHOWER BATH.

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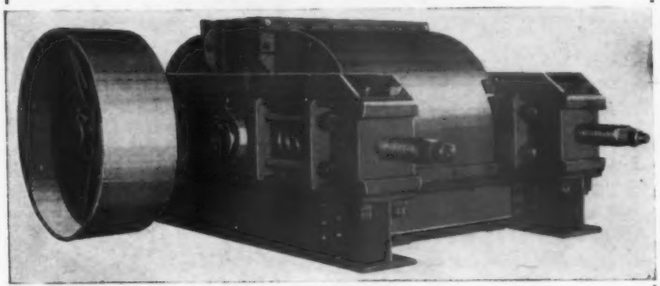
DESIGNED ALONG SOUND, PRACTICAL ENGINEERING PRINCIPLES
WITH OR WITHOUT FEEDERS



COMPACT, POWERFUL, DOUBLE ROLL CRUSHERS

MADE IN ALL SIZES
CORRUGATED OR PLAIN
TO MEET ALL CONDITIONS

Convert your SURPLUS SIZES of gravel or crushed stone into MARKETABLE MATERIAL

Write your requirements to the

F. M. WELCH ENGINEERING SERVICE
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. . . for Efficient Screening Over Entire Area

USE **LINK-BELT VIBRATING SCREENS**

Designed and built to be easy on itself — to avoid unnecessary wear—the Link-Belt Vibrating Screen lasts a long time with few repairs. Low in first cost —low in maintenance—an economical screen to operate. Send for 24-page illustrated catalog, complete with clearance diagrams and dimension tables on the two distinct types of Link-Belt vibrating screens ("UP" and "PD").

Ask for No. 1562. Address Link-Belt Company, Philadelphia, Chicago, Indianapolis, Atlanta, San Francisco, Toronto, or any of our offices located in principal cities.

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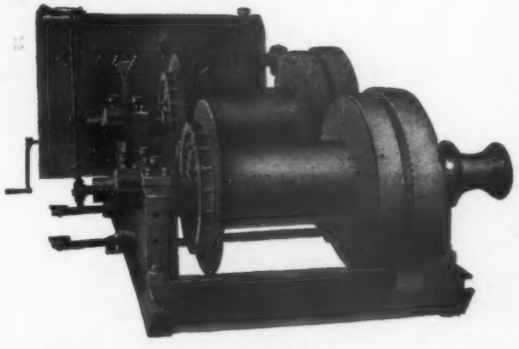
For Tough SERVICE



Often the work schedule on the job depends upon continuous and unfailing **hoisting service**—which is always assured by the use of O K HOISTS. They are built with extra strength, lifting power and endurance to stand the heavy demand of modern operations. Single and multiple drum types for belt, gasoline or electric drive in all capacities. Write for list of sizes.

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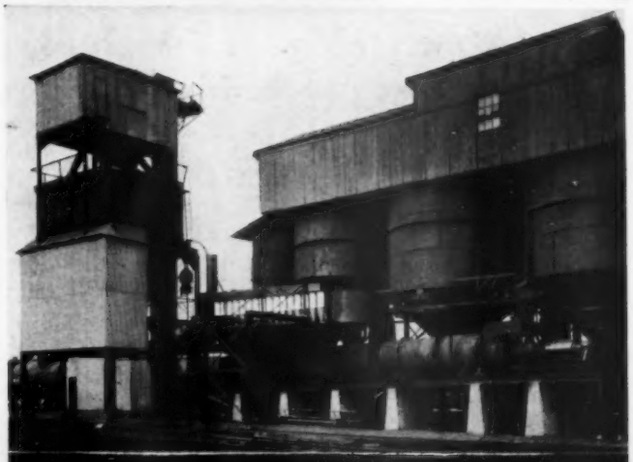

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HOT MIX —— COLD MIX
—— OR ——
COMBINATION UNIT FOR BOTH TYPES

CAPACITY DESIGN AND ARRANGEMENT
TO MEET
ANY REQUIREMENTS

Designed and Built
—— By ——
WARREN BROTHERS ROADS CO.
P. O. BOX 1869
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DREDGING PUMPS

DEFINITELY
Longer service life
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Low maintenance costs
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With a Sauerman Slackline or Drag Scraper you can dig and haul any distance up to 1500 ft. for a few cents per yard. Sixteen sizes with capacities from 10 to 500 cu. yds. hourly.

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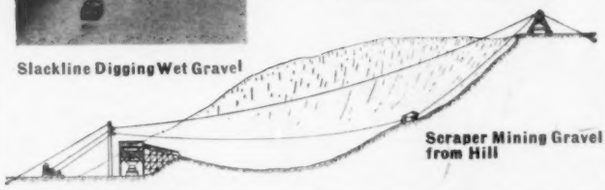

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FOR BIGGER DAILY YARDAGE

Power-Arm Buckets.
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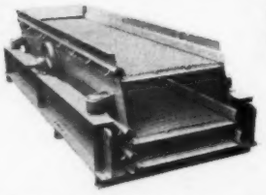
TYLER SCREENS

CIRCLE-THROW MECHANICALLY AND ELECTRICALLY-VIBRATED



and Woven Wire Screen
In all Meshes and Metals

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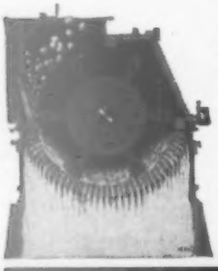
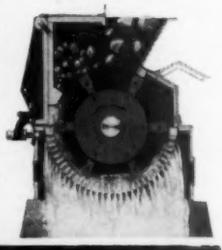
Reduce Anything . . . Including Costs with Jeffrey Reduction Units



It's surprising how many materials are being successfully reduced with Jeffrey Swing Hammer Pulverizers and Crushers. There is a type and size to meet any capacity requirement you may have.

Superior to any Reduction Units on the market today—that's Jeffrey.

Catalog No. 550-G



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BUCKET ELEVATORS
REVOLVING SCREENS
CRUSHERS DRY PANS

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Lewistown, Pa.

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LONG - MESH
WOVEN WIRE SCREENS

LUDLOW-SAYLOR
WIRE CO. ST. LOUIS

Only the **SELECTRO** by JIGGER
GIVES YOU A VIBRATING SCREEN WITH—

1. Selective Vibration, Throw
2. Full Tilting
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4. Oil—Not Grease—Lubrication
5. Ruggedness, Low Operating Costs

Send for new data book on screening

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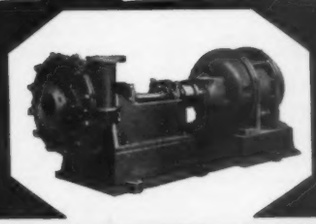
MORRIS
CENTRIFUGAL PUMPS



For handling abrasive materials, corrosive liquids, or clear water. Special designs and materials for each service to provide long life, maintenance of initial high efficiency and low upkeep cost.

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HEAVY DUTY
DRYERS
Rotary Type

OIL OR COAL FIRED
ENGINEERED TO
MEET ANY
SERVICE
REQUIREMENT

ASK WHAT WE HAVE DONE FOR OTHERS

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ROUND
SQUARE
SQUAROUND*
HEXAGON
PERFORATED
PLATE
of every description
for maximum productiveness from your vibrating screens.
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for All Industrial
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TRANSMISSION BELTING
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You'll get more for your money at Pick Hotels. Spacious, comfortable rooms. Delicious food and real personal service. All at moderate prices.

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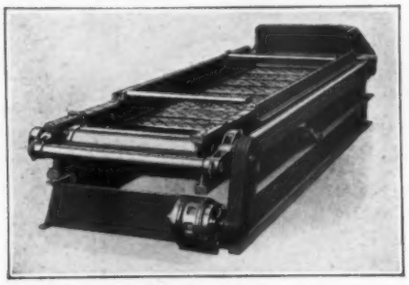
WHENEVER YOU SEE THE WORD **PICK** THINK OF ALBERT PICK HOTELS

SYMONS SCREENS



Sets level
Saves headroom
Greater capacity
Closer sizing
Automatic feed
Dust-tight bearings

Used on the World's largest projects including COULEE DAM, COLORADO RIVER AQUEDUCT, BOULDER DAM, T.V.A. and many others. Write for performance records.

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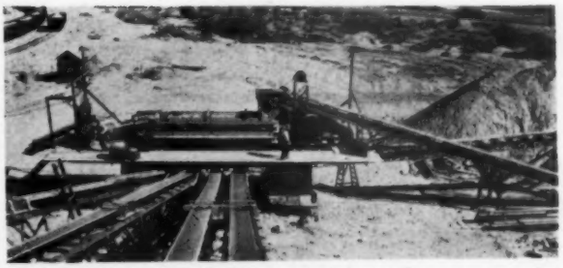

At Hawley plant of Colorado River Aqueduct, Symons Screens are separating 200 tons per hour into four graded sizes

FOR SALE

1—100 H.P. Slip Ring General Electric Motor No. 26082. W.R. Serial 25594, Model 56. Voltage 440, 600 R.P.M. Complete with base, instrument panels, and wire. Condition good.

Price **$375.00**

1—200 H.P. Westinghouse, 440 Volt, 3 phase, 60 cycle, 700 R.P.M. Slip Ring Motor with base pulley, drum controller, starting resistance and primary ammeters. Condition good.

Price **$850.00**

1—Variable speed 21 H.P. Westinghouse Slip Ring Motor. Serial No. 4391077, R.P.M. at full load 870, voltage 440, Rotor Circuit 147 volts between rings and 46 ampers per ring.

Price **$300.00**

1—Eagle "Swintek" screen nozzle ladder or digger. Size 8", length of ladder 40', heavy duty construction. Chain and driving sprocket of Amsco Manganese Steel fitted with carrier and side cutter attachment links. Needs a few new pins otherwise in good condition.

Price **$2000.00**

1—Two section Steel Barge. Dimension of each section—12'-6"x 50'x5'.

Price **$2100.00**

1—Two section Steel Barge. Dimension of each Barge—Depth 3', width 8', length 30'.

Price **$1500.00**

Both of the above barges in good condition.

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1—8" semi-steel sand pump in good condition. Brand new shell.

Price **$750.00**

1—6" Morris Manganese lined sand pump in good condition.

Price **$500.00**

THE BLUE RAPIDS GRAVEL CO.
Blue Rapids, Kansas

An unusual offering!

6½ yard MINING or STRIPPING SHOVEL

Bucyrus 320-B 2200/4000 volt, 3 ph. 60 cycle, A.C.—250 volt D.C. Ward-Leonard control. 90 ft. boom and 58 ft. dipper stick. Built 1925 and used only two years. Very good condition.

Located near Madisonville, Ky. Part cash terms if necessary.

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Phone: HARrison 0163
"Anything so long as it contains IRON or STEEL"

USED EQUIPMENT BARGAINS

1—O & S ¾ yd. Crane, 35' boom	$1,000.00
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All items are offered F.O.B. St. Louis, in good operating condition and subject to prior sale.

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50 H.P. 1800, 3/60/220 Allis Chalmers sqr. cage
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75 H.P. 1750, 3/60/220 General Elec. sqr. cage
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100 H.P. 720, 3/60/220 Westinghouse slip ring
100 H.P. 900, 3/60/220 General Elec. synchonous
150 H.P. 600, 3/60/220 General Elec. sqr. cage
150 H.P. 600, 3/60/440 General Elec. slip ring

A.C. GENERATORS
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4½x4½ single, 4½x4, 6x6 duplex vertical
7x6, 12x10, 14x12 Ingersoll-Rand horizontal

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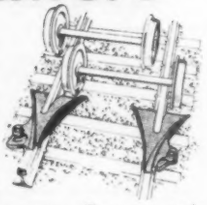

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3 Ph. 60 Cy.

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600	Al. Ch.	Synch.	440	450
500	G. E.	Synch.	440	1200
450	West.	Synch.	440	257
450	West.	S1. Rg.	2300	875/700
400	G. E.	S1. Rg.	2300/550	390
400	West.	S1. Rg.	2300/550	290
400	G. E.	S1. Rg.	440/220	505
400	West.	S1. Rg.	2300	514
400	G. E.	S1. Rg.	2300	885
300	Al. Ch	S1. Rg.	2300/550	585
250	G. E.	S1. Rg.	4000/2300	257
250	West.	S1. Rg.	440/220	585
250	F. Morse	S1. Rg.	2300/550	1200
225	El. Machy.	Synch.	4150/2300	450
220	G. E.	Synch.	2300	900
200	West.	Synch.	440	514
200	West.	Synch.	2300/550	1800
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200	West.	S1. Rg.	440/220	900
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1—Clamshell, Keisler ½ yard.
2—Union 1 yard controllable bottom dump.
1—Hayward 2 cu. ft. orange peel.
1—Backfill scraper bucket.

GAS HOISTS
Also Without Power

1—Clyde D.D. with attached swinger and 50 H. P. 4 cyl. engine.
1—Clyde D. D. 30 H. P. 4 cyl. eng.
1—Cloverleaf S.D. with elevator sheave reversible, 4 cyl., LeRoi.
1—National S/D reversible with elevator sheave, 4 cyl., LeRoi.
2—Novo as above with 10 H. P.
1—Novo S/D with 6 H. P.
1—Orr & Semblower power.
1—Sasgen double drum hand winch.

STEAM HOISTS

9—Lambert—Lidgerwood—Orr & Semblower 8¼"x10"—9"x12" & 10"x12".

DERRICKS

2—American-Terry steel stiff leg., 90 ft. boom; cap., 10 to 15 ton.
1—American-Terry steel stiff leg, 100 ft. boom; cap., 15 ton.
1—Set Sasgen 5-ton stiff leg irons for wood derricks.

CRUSHING PLANT

1—Russell No. 10 portable screening outfit with Universal 8"x36" jaw crusher. Including the following items:
1—24"x40 ft. conveyor.
1—18"x40 ft. conveyor.
1—Steel 16 yard bin.
1—Novo double drum hoist equipped with 55 H. P. Waukesha motor.
1—Pioneer 1 yard drag scraper bucket.

ELECTRIC HOISTS

1—Sauerman three drum 75 H. P. A/C for drag scraper work with 2 yard drag bucket.

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Pumps.
Piling Hammers.
Concrete Mixers.
Tractors.
Locomotives, Etc.

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RENNOLDS EQUIPMENT CO.

13904 SOUTH HALSTED ST. TELEPHONE: RIVERDALE 139 BLUE ISLAND, ILL.

FOR SALE

AMERICAN 70 ton 6-wheel switching locomotive with separate tender, 20x26" cylinders.

AMERICAN 50 ton 4-wheel saddle tank locomotive, 16x24" cylinders.

AMERICAN 40 ton 4-wheel saddle tank locomotives, 14x22" cylinders, six duplicates.

AMERICAN 30 ton 4-wheel saddle tank locomotive, 12x18" cylinders.

BALDWIN 75 ton 6-wheel switching locomotive with separate tender, 21x26" cylinders.

BALDWIN 55 ton 4-wheel saddle tank locomotive, 18x24" cylinders.

BALDWIN 40 ton 4-wheel saddle tank locomotives, 14x22" cylinders, three duplicates.

PORTER 36 ton 4-wheel saddle tank locomotives, 14x20" cylinders, two duplicates.

VULCAN 33 ton 4-wheel saddle tank locomotives, 13x18" cylinders, two duplicates.

VULCAN 21 ton 4-wheel saddle tank locomotive, 11x16" cylinders, six duplicates. 36" gauge.

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Birmingham Alabama

SPECIALS FOR SALE

Lorain Model 75-B gasoline crawler type 1¼ yard shovel; late model; rebuilt; A-1 condition.
P&H Model 300-B crawler type combination shovel and dragline; Buda Diesel Engine; ⅝ yard shovel; ½ yard drag; 40' boom; new 1935.
Brownhoist 20 ton capacity eight wheel type locomotive crane; 50' boom.
Eight 12 yard Western automatic air dump cars; vertical cylinders; steel draft sills.
Ten 6 yard Western standard gauge hand dump cars; steel draft sills.
Three 27 ton American four driver saddle tank steam locomotives.
Baldwin 80 ton 6 wheel switching type locomotive; cylinders 22"x26"; 37,600 lbs. tractive power; new 1922.

HAVE CONSIDERABLE OTHER EQUIPMENT IN STOCK REBUILT READY FOR DELIVERY

Southern Iron and Equipment Co.

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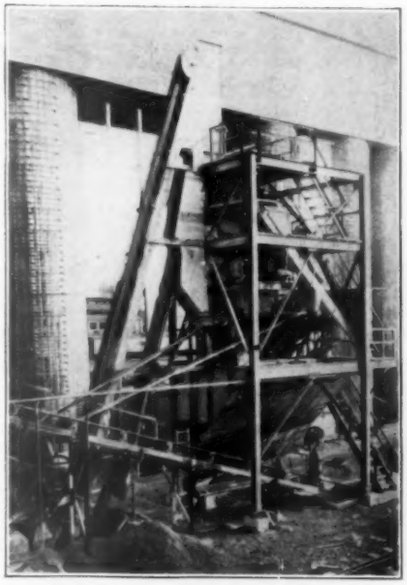
1—Stroudsburg 3 Drum Drag Line Hoist equipped with 1" cables. 9,000 lbs. on single line, 200 ft. per min.
5—Allis Chalmers Gyratory Crushers "8K"—"6K"—"6D"—2—No. 2 Std. "McCully"
2—Rotary Screens 5' diam. x 30'—3' diam. x 20'
1—30-B Bucyrus Steam Shovel & Crane Combination

M. S. ROSEN
Menands Bridge Approach
Albany, New York



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150 Ton, 50 Ft. RR Track Scale.
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22x80 Vertical Bucket Elevator.
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85 KW 250 V., DC., 220 V., AC M.G. Set.
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30 In. by 10 ft. Feeder & Mag. Pulley.

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Pneumatic Tools of All Kinds.
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Gyratory Crushers—No. 3 to No. 21.
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Shovel P & H Diesel 3½ yd. cat mounted.
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Portable Lime Pulverizer.
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1—THOMAS 55 H.P. two drum, two speed electric hoist.
1—Lidgerwood 9x10 two drum steam hoist.
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12—Head and tail pulleys with drives takeups and bearings for 24" and 30" conveyor belts.

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225 HP Anderson Diesel eng., new crank-shaft.
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6" Superior McCully Fine Crusher 90% new.
36" Allis-Chalmers Superior McCully Crusher.
2½ yd. Diesel Shovel-Dragline, new 1935.
No. 3 & No. 5 Williams Hammermills. Also others.
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Modern Gravel Plant complete, makes 5 grades.
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1—20 ton Industrial Locomotive Crane.
1—50-B Bucyrus Steam Shovel—Dragline.
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Dump Cars, Locomotives, Shovels, Draglines.

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14" belt with 12" bucket.
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Long and short lengths, very low prices.
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Complete 36" BELT CONVEYOR FOR SALE.

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Conveying and electrical equipment and other sand plant equipment.

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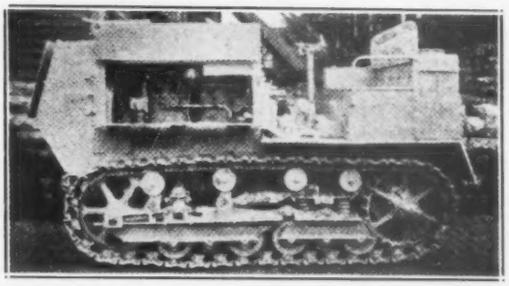

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2—5x26', 5x30', 70"x35', double shell Ruggles-Coles Dryers.
12—Direct heat Rotary Dryers, 3x30, 4x30, 5x50, 5x60, 6x60.
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2—8'x110' Bonnot Rotary Kilns.
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12—Jaw Crushers—No. 1436 Cedar Rapids; No. 1536 Universal; 18x24 Reliance; 24x36 Farrell, Buchanan; 36x42 Traylor, Farrell; 42x60 Farrell; 48x60 Allis-Chalmers; 48x72" Buchanan.
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1—GE. motor 200 HP. slipring.
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2 New Jigger 3-Deck 3x8 Vibrating Screens.
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Hummer Screen Generators, 8 KVA, 110-volt, complete with panel board.
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Cont. Belt Elevator 60' high & 36" buckets.
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1—Flory 18" dia. complete with 50 HP motor.

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35-ton McMyler Locomotive Crane
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12-ton Whitcomb Gas Locomotive
8-ton Plymouth Gas Locomotive
6—5-Yd. 36" Gauge Dump Cars
½-yd. Byers Comb. Shovel-crane
1245 ft. Ing.-Rand Compressor
450 ft. Ing.-Rand Compressor
Barber Greene Bucket Loader 42B
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4½ x 6 Swinging Engine
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4—Pile Hammers, Nos. 3, 7, 9B2 McK.
Crane Attachment for Marion 32 Shovel

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1—Northwest No. 7 gas crane, 1¾ yds. cap. 70' boom.
1—Lima comb. 1½ yd. shovel, 55' crane boom.
1—Loraine comb. 1¼ yd. shovel and crane.
1—Loraine gas shovel, 1½ yd.
1—Byers gas 1 yd. Model 100 shovel and crane.
2—Osgood heavy duty steam, 1¼ yd. shovels.
1—Browning truck crane on Mack truck.
2—Locomotives, gas, 20 tons, 36" ga. Whitcomb.
1—Locomotive, gas, 20 tons, 36" ga. Vulcan.
1—Locomotive, gas, 4½ tons, 36" ga. Vulcan.
25—Cars, 5 yards, two way dumps, 36" ga.
10—Cars, 2 yds., steel V dump, 36" ga.
Conveyor belt systems, 20", 22", 30" complete.
50—Rock drills, DCR-23, X59, X49, 870, others.
10—Concrete breakers, pneumatic.
30—"BARRE" pneumatic carving tools, BL, CL, DL.
1—Bucket elevator, 32'.
1—Air compressor, 514 cfm, 14" x 12", electric drive.
1—Air compressor, 900 cfm, Deisel drive, Worthington.
1—Air compressor, 1,200 cfm, I. R., type PRE-2, elec.
1—Screen, Telsmith vibratory, 4' x 12', 5 h.p. motor.
5—Motor trucks, 5 yards, dump.
2—Derricks, steel stiff legs, 15 tons, cap. 100' booms.
4—Derricks, steel guy, 7½ tons cap., 75' booms.

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Jaw Crushers: 9x16 up to 60x84.
Rotary Dryers: 4½x30, 5x50, 6x55.
Smooth Face Crushing Rolls: 54x24, 42x24, 36x16, 40x15, 30x16, 20x14, 16x10.
60 Ft. Guy Derrick Handling Outfit with 60 HP Gas Hoist.
1 yd. Sauerman Elec. Slackline Outfit.
1¼ & ¾ yd Marion Elec. Cat. Shovels, A.C.
Tube Mills, 7x22, 7x10, 6½x16, 5½x20, 5x22, 5x18.
21½ Sturtevant Ring Roll Mill.
30" Griffin Mill.
250 Ton Hydraulic Forcing Press.
Pennsylvania 8-7 Hammer Mill.
Williams 23 Helix Seal & Universal Mills.
No. 0 Raymond Pulverizer.
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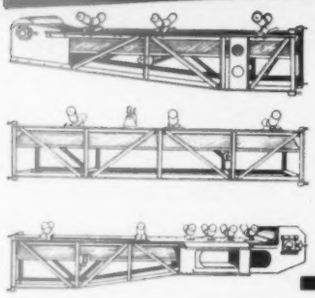

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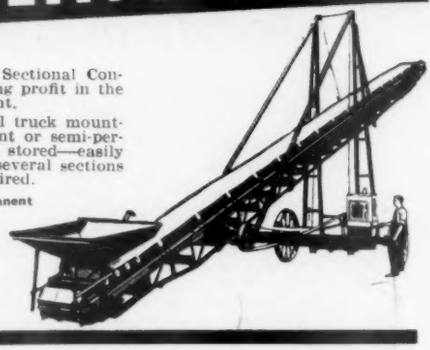
Our Catalog describes our complete line of Portable, Sectional and Permanent Conveyors designed to suit every Pit and Quarry requirement.



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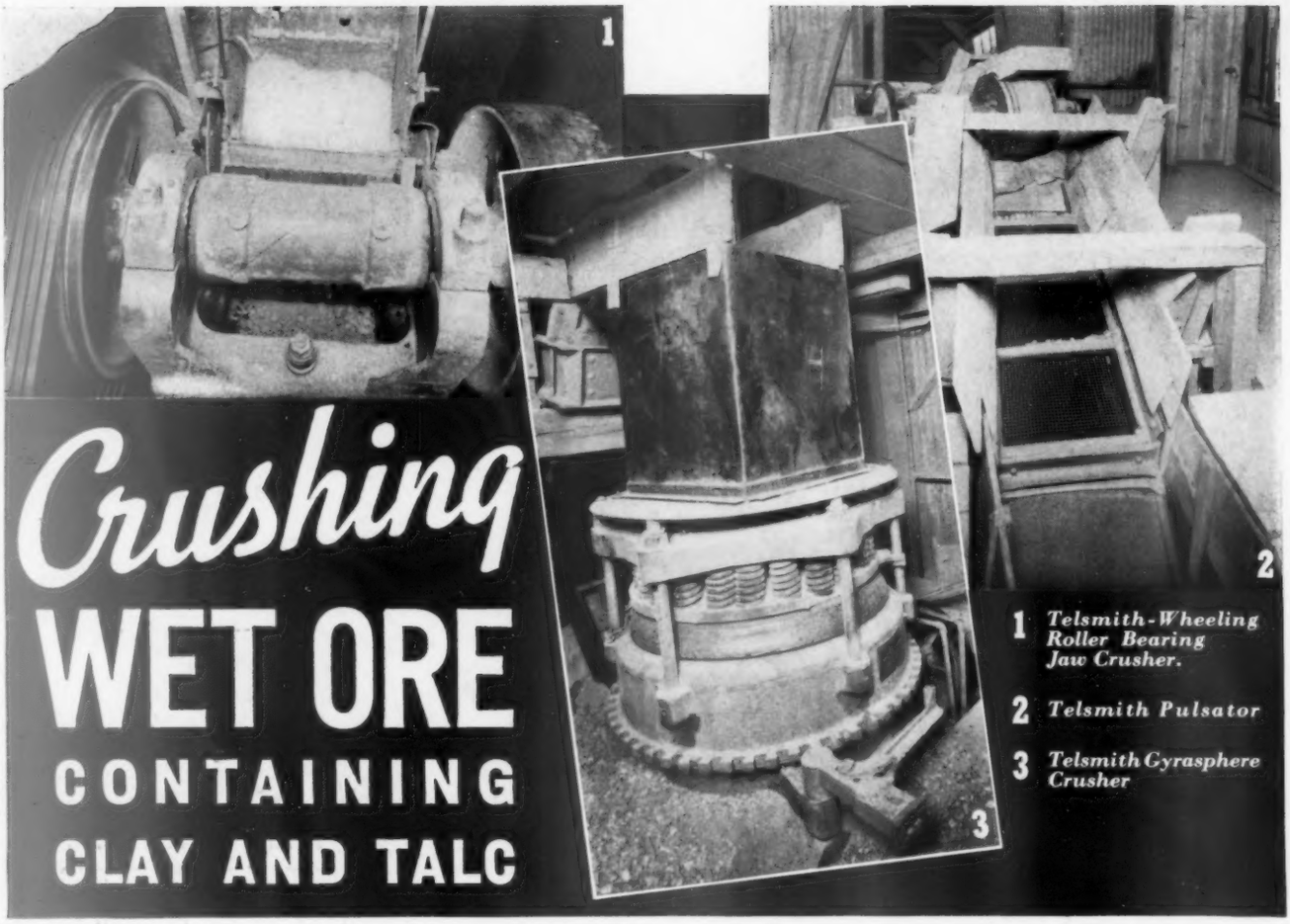


Crushing WET ORE CONTAINING CLAY AND TALC

1 *Telsmith-Wheeling Roller Bearing Jaw Crusher.*

2 *Telsmith Pulsator*

3 *Telsmith Gyrasphere Crusher*

To develop their Comet Mine, the Basin-Montana Tunnel Co. of Basin, Montana, after the most careful investigation, selected Telsmith crushing equipment. Operation, begun early in 1934, has been continuous. The mill is now operating at 200 tons per day, with an ample margin of surplus crushing capacity.

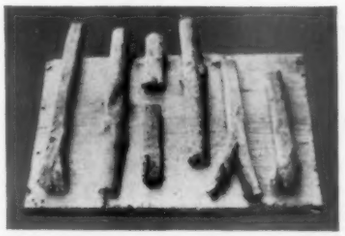
The metals mined are zinc, lead, silver and copper, with some gold. Ore is very hard and abrasive. Much of the rock is wet, containing clay and talc, making a difficult crushing problem.

Ore from the mine first passes through a 9″ x 30″ Telsmith-Wheeling Roller Bearing Jaw Crusher and is crushed to about minus 1½″. Then it is conveyed to a 2′ x 6′ Telsmith Single Deck Pulsator, with ⅜″ square openings in screen cloth. Oversize from this vibrating screen goes to a No. 24 Telsmith Gyrasphere Crusher originally set to deliver minus ½″, now minus ⅜″ product. According to the management this Gyrasphere has given excellent service . . . crushing from 5700 to 11,000 tons of ore with one set of manganese wearing parts, this wide variation being due to the change in adjustment. Oiling system is positive, without dust seal failures. Repair expense is moderate; mechanical performance has been satisfactory; and power consumption low. The Basin-Montana people report, "We like Telsmith equipment."

Write for descriptive Bulletins—Y-15 Telsmith Gyrasphere Crusher; W-15 Telsmith-Wheeling Jaw Crusher; V-15 Telsmith Pulsator.

TRAMP IRON DOES NOT STOP TELSMITH

Actual photograph of tramp iron which passed through both Telsmith jaw Crusher and Gyrasphere Crusher in plant of Basin-Montana Co., yet failed to damage either crusher in any way.



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